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EDITED, PRINTED AND PUBLISHED BY J. C. ROBERTSON, 166, FLEET STREET.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 843.] SATURDAY, OCTOBER 5, 1839. [Price 3*d.*

Printed and Published for the Proprietor, by W. A. Robertson, No. 166, Fleet-street.

CAPTAIN SMITH'S PADDLE-BOX BOATS.

Fig. 2.

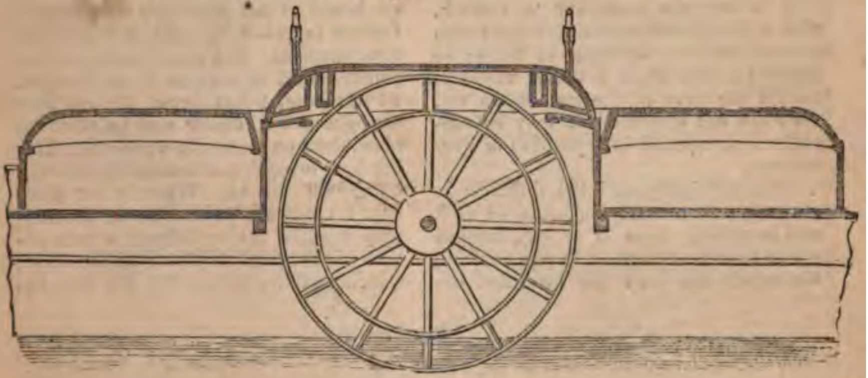
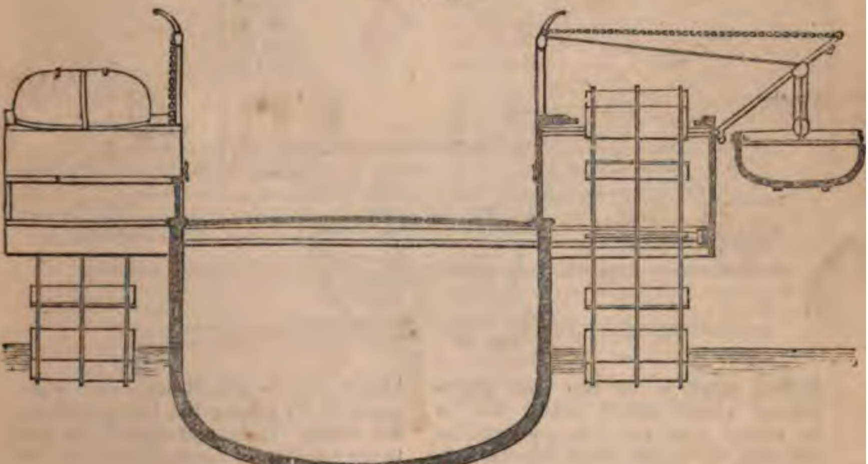


Fig. 3.



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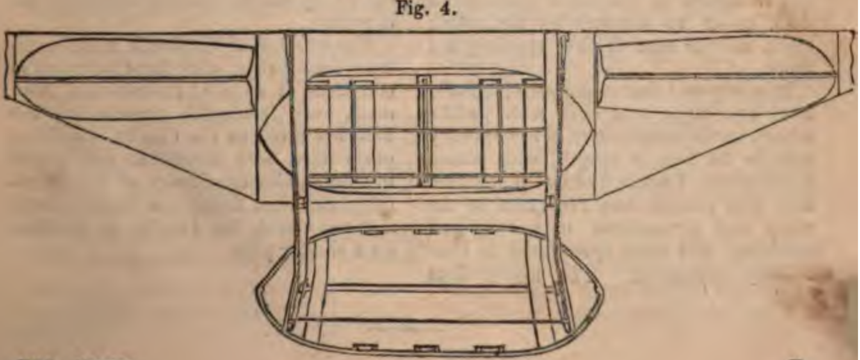

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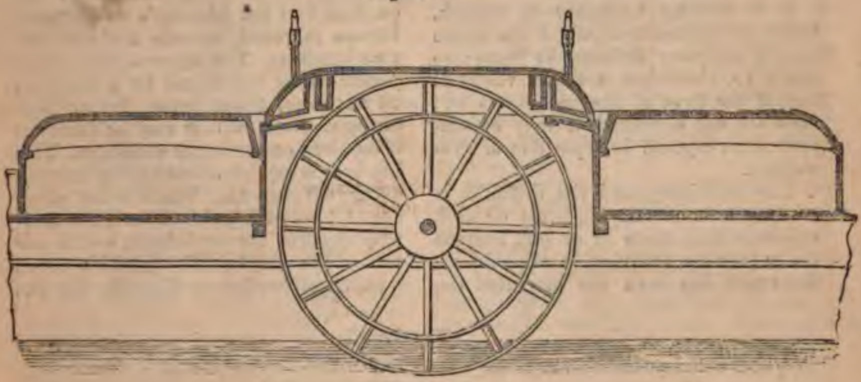

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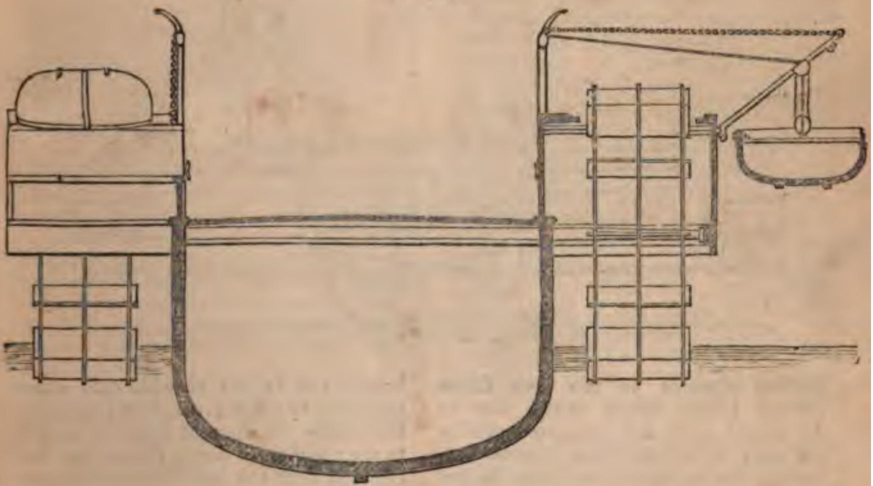

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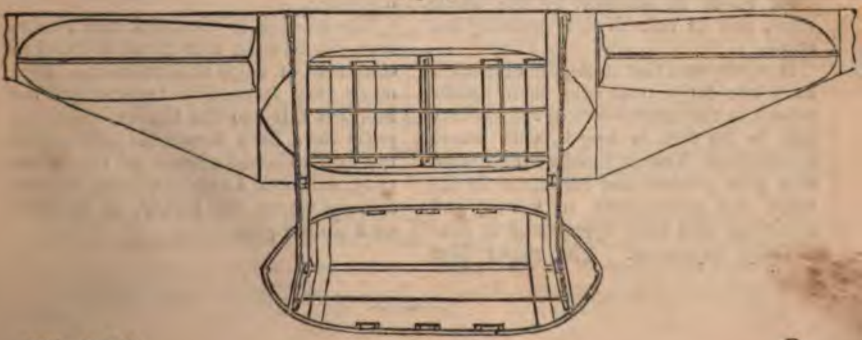


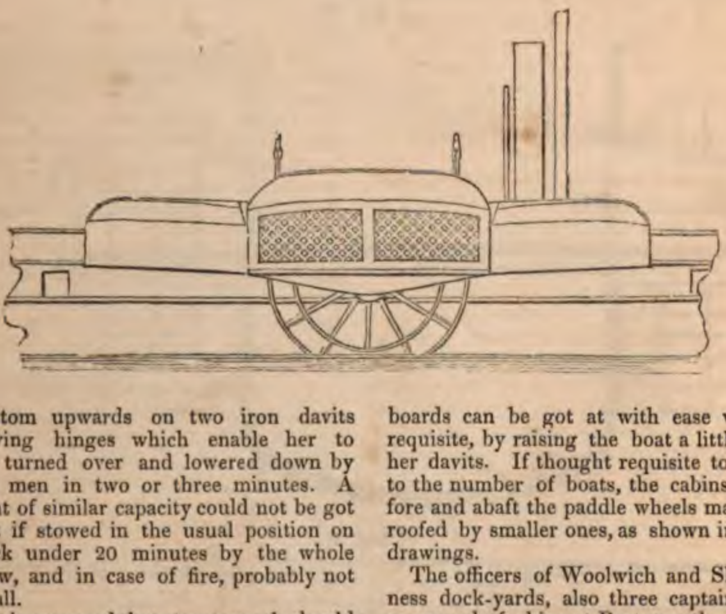
CAPTAIN SMITH'S STEAM VESSEL PADDLE-BOX BOATS.

[*From the Appendix to Report on Steam Vessel Accidents.*]

It is scarcely necessary to remark, that it is universally admitted that steam vessels are very deficient in boats; so much so, that when a steam vessel is lost, if the lives of the passengers and crew are not sacrificed, it may be considered an especial interposition of Providence.

This deficiency, and the difficulty in steam vessels of carrying boats on deck and in getting them in or out, has led me to turn my attention to the subject; the result has been the invention described in the accompanying drawing (see front page, and below), which invention my Lords Commissioners of the Admiralty have been pleased to try on board of her Majesty's steam vessel *Carron* (a vessel between 200 and 300 tons burthen). The upper section of her paddle-wheel is covered by a life-boat, 25 feet long, 9 feet beam, having four air-tight cases, which may be removed if required on particular occasions. This life-boat is capable of containing between 40 and 50 persons. When in her place (fig. 1.) over the paddle wheel, the midship thwarts are unshipped, which admits of the wheel revolving within about 6 inches of her kelson (fig. 2.), she lies

Fig. 1.



bottom upwards on two iron davits having hinges which enable her to be turned over and lowered down by six men in two or three minutes. A boat of similar capacity could not be got out if stowed in the usual position on deck under 20 minutes by the whole crew, and in case of fire, probably not at all.

It is proposed that steam vessels should have one large boat over each paddle wheel; in the most powerful vessels they may be 30 feet in length, with above 9 feet beam. Vessels fitted with boats on this plan present less resistance to the wind and atmosphere in sailing and steaming, and their appearance is con- improved. The upper float boards can be got at with ease when requisite, by raising the boat a little on her davits. If thought requisite to add to the number of boats, the cabins, before and abaft the paddle wheels may be roofed by smaller ones, as shown in the drawings.

The officers of Woolwich and Sheerness dock-yards, also three captains in command of ships at Portsmouth, have made very favourable reports on the life-boat fitted to the *Carron*, which reports have been forwarded officially to my Lords Commissioners of the Admiralty, and their Lordships have ordered a larger vessel, the *Firefly*, to be fitted on a similar plan.

INSTRUMENT FOR RESTORING SUSPENDED ANIMATION.

Sir,—Having seen in the *Literary Gazette* of August 24th, that Dr. Fairbrother, of Clifton, has restored animation by stopping the mouth and sucking the foul air from the lungs through the nostrils, while respiration was promoted by pressure on the chest,* I send a sketch of an instrument to be used in restoring animation, and I hope for its insertion.

As workmen are the persons most likely to be near when a person is taken out of the water, it would be desirable that the knowledge of rendering assistance should be widely diffused. The extensive circulation of the *Mechanics' Magazine* will bring the following plan under the consideration of many.

The instrument resembles a funnel, with a large aperture in the side; opposite this large aperture, there is a short tube, the orifice of which can be covered completely by the thumb. This orifice may be called the thumb orifice.

The instrument is to be placed over the mouth and nostrils of the person to be relieved, and the thumb orifice is to be closed by the operator. The large aperture in the side of the instrument is to allow the lower part of the nose to fit into it.

If the operator apply his mouth to the top of the funnel to exhaust the air from the lungs, he will not succeed, because the instrument does not fit air-tight. The question is, how to render it so.

This can be easily done by using some soft tenacious substance easily got, round the edges, when applied, dough or putty will answer; even butter may be used if nothing else can be promptly got.

When the instrument is rendered air-tight, the operator can exhaust the foul air from the lungs while pressure is made on the chest and sides. When the pressure is relaxed, the chest, by its elasticity expands, and the thumb of the operator is to be removed to allow fresh air to rush in through the thumb orifice to the lungs.

In this way natural respiration is to be imitated by frequently repeating the process.

Experiments carefully made in France have shown that great mischief to the lungs can be done by bellows for injecting air, in unskilful hands. There the use of a broad bandage pulled tight round the body and relaxed frequently to imitate the contraction and expansion of the chest is everywhere recommended.

The plan here described is simple, the instrument is cheap, injury does not arise from its use. If it were made without the thumb orifice, some foul air contained in it would be drawn into the lungs again every time the operator would withdraw his mouth from the top of the funnel, and when he would cause the pressure on the chest to be relaxed.

This funnel should be kept in a box, and a canister containing the soft substance to render it air-tight should be kept with it. Plain and concise directions should be pasted on the inside of the box.

The top of the funnel ought to be small, that the mouth of the operator, should be able to command the exhaustion.

I have frequently caused a partial vacuum with a small glass funnel placed over the ear. In this case the entire ear is to be put under the funnel, which is to be pressed down close to the irregular surface near the ear. Soft putty is then placed round the edges, and the operator applies his mouth to the top of the funnel to cause an exhaustion.

In some kinds of deafness instantaneous relief is thus afforded, when there is some obstruction of the Eustachian tube.

When the edges of a funnel in contact with the hard and irregular surface near the ear can be rendered air-tight, there can be no difficulty in rendering an instru-

* See Notes and Notices, last Number, p. 479.

ment so, over the mouth and nostrils in like manner.

It may be asked, would it not do to have an instrument that would only include the nostrils. It is better to include the mouth also, because there might be some obstruction in the nostrils that would interfere with the free admission of air.

No one can tell but that the upsetting of a boat might cause himself to be the person to whom assistance would have to be afforded.

The diffusion of whatever is useful cannot be too general. This instrument may be the means of saving many lives.

I have the honour to remain,
Your obedient,
JOSEPH MACSWEENEY, M.D.

ork, Sept. 7, 1839.

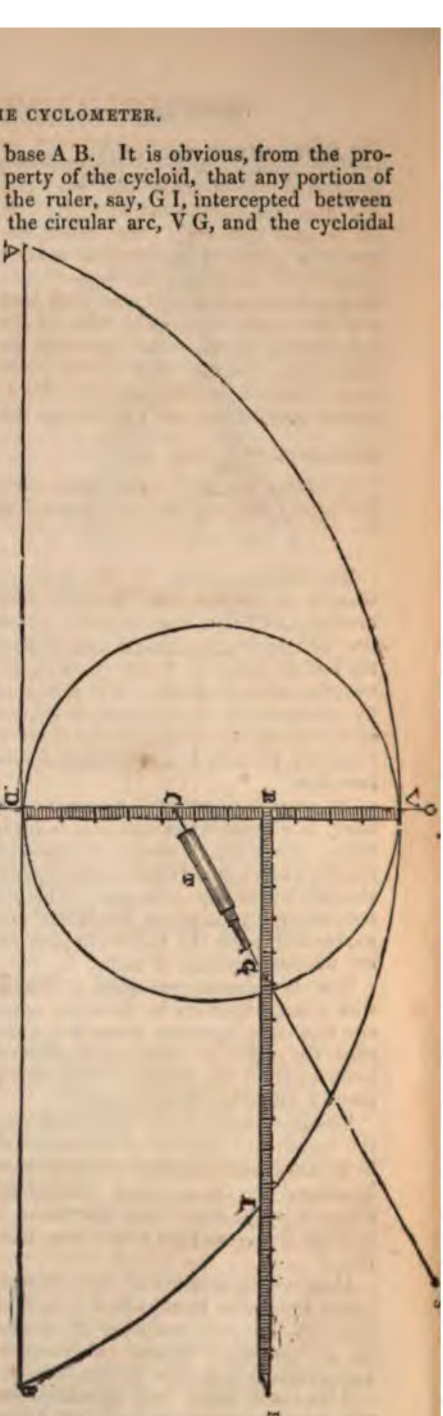
DESCRIPTION OF THE CYCLOMETER, AN INSTRUMENT FOR MEASURING THE ARCS OF CIRCLES, ANGLES, WITH RIGHT SINES, CO-SINES AND VERSED SINES. — INVENTED BY MR. WILLIAM S. V. SANKEY, M.A.

Sir,—Many years ago it occurred to me that the properties of the cycloid might be advantageously applied to measuring circular arcs, &c., so as to reduce the measurement simply to that of a right line. From the very flattering notice which your intelligent correspondent O. C. F. (in your No. 316, p. 18,) did me the honour to take of my geometrical rectification of any arc of the circle I am induced to hope you will give insertion to my ideas, in your valuable journal,

I am, Sir, yours truly,
WILLIAM S. V. SANKEY.

April 16, 1839.

Let A V B be a cycloid, A B its base, and V D its axis, as also the diameter of the generating circle, V G D. Let this cycloidal periphery, as also the circular periphery be *accurately* and deeply cut upon a metallic plate, and let the diameter be divided by a graduated scale. Let a strong wire be affixed to the plate, and let this wire, P R, be parallel to the diameter V D, and raised a little above the plate, so that the wire P R, and the diameter V D, be in a plane perpendicular to the plane surface of the metallic plate. To this wire let a graduated ruler E H *be attached* so as to move freely along *the wire, at the same time* parallel to the base A B. It is obvious, from the property of the cycloid, that any portion of the ruler, say, G I, intercepted between the circular arc, V G, and the cycloidal



arc V I, will be equal to the circular arc V G, and, being graduated, will therefore measure the same while the portion of

the ruler E G, intercepted between the wire and the circular periphery, being graduated will measure the sine; also, the diameter being graduated, E C, the intercepted between C, the centre, and the ruler at E, will measure the co-sine, while E V measures the versed sine. Hence, this instrument, if accurately made will be a ready *mechanical* table of circular arcs with their corresponding natural sines, cosines, and versed sines, while tangents, co-tangents, &c. will be readily found from the well known formula, $\text{tang} = \frac{\text{sin.}}{\text{cos.}}$

In order to apply this instrument for taking observations, an instrument furnished with sights, or a telescope, as T, should be fixed at the centre C, turning on a swivel. It should be provided also with the proper apparatus of micrometers, &c. It is obvious the ruler E H should be at least equal to D B, the semi-base of the cycloid = the semiphery of the circle.

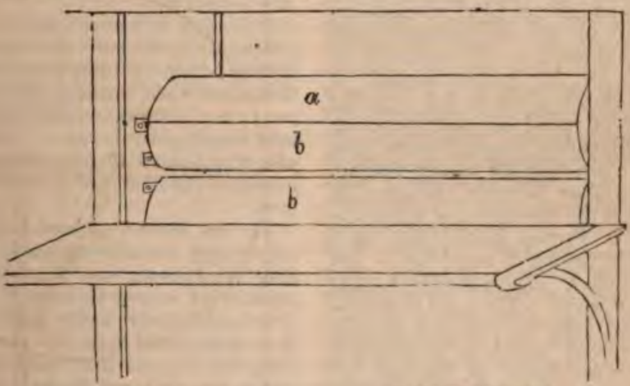
This instrument, which seems to me to recommend itself by its simplicity, I have denominated a cyclo-meter, as being a measurer of the circle, and therefore appropriately named by the compound, from χυχλος, *a circle*, and μετρον, *a measure*.

WILLIAM S. V. SANKEY.

30, Harmood-street, Camden Town, London.

IMPROVEMENT IN BOOKBINDERS ROLLING MACHINES.

Fig. 1.



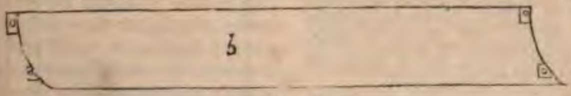
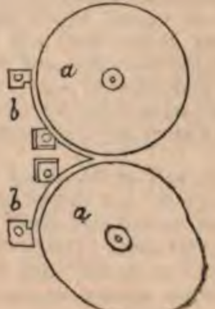


Fig. 2.

Fig. 3.



Sir,—In consequence of numerous accidents that have come within my knowledge resulting from the want of something to guard the hands from being drawn between the cylinders of bookbinders rolling machines, I have devised a plan to prevent them, which I send for insertion in your valuable Magazine. In my improved rolling machine, the improvement consists of two shields, one for each roller; the shields I propose to be made of well-hardened iron, about ⅛th of an inch in thickness, to *extend half up, and half down each roller, the shield being kept apart* the same

distance as the space between the rollers, and to be fixed to the sides of the machine. The rollers to work within them.

Fig. 1, The rollers with the shields complete; *a* the upper roller, *b b*, the shields.

Fig. 2, One of the shields shown separately.

Fig. 3, A section, or side view of the rollers with the shields fixed.

By your insertion of this, you will not only confer a favour on me, but perhaps be the means of saving many a man of family from being incapacitated for work.

Yours, &c.

C. SANDERS, Bookbinder.
No. 185, Drury Lane.

BLEACHING PROPERTIES OF BRIMSTONE—HINT TO FARMERS.

Sir,—About thirteen or fourteen years ago, from an interest I had in manufacturing glue and also size for paper-stainers, I was induced to try a variety of experiments on the French method (at that time shown in one of their scientific bulletins) of clarifying and bleaching glue. My attention was withdrawn from it by my concern in the matter ceasing. I well remember, however, that from the obscurity of the description of manipulation in the French publication, there were difficulties which could not be got over, although the materials became beautifully white. The great deterioration of the glue, its adhesive qualities being reduced one-third to one-half, rendered it useless for all purposes except for pastry cooks, who, I believe, occasionally practice this mode of preparation to make their jellies keep in summer, as well as to clear them.

Mr. Rattray of Aberdeen has taken out a patent for a modification of the French method of clarifying glue. He uses the hydro-sulphurous acid weakened by the addition of water. But I understand from glue dealers that it is rendered much weaker from the acid combining with the glue, and the price it is offered at in the market, three pence per pound more than other glue, precludes the use of it.

The method of bleaching silk and woollen goods, and indeed all animal substances, by the combustion of brimstone, is well known. But the bleaching of resinous substances, and of straw, -d, and other fibrous matters, so as to render them more fitted for the various uses to which they are and may be applied, is not known, at least not practised. Straw well washed, soaked in lime, and macerated therein for ten days or a fortnight, then washed again and submitted, as is done by the straw bonnet makers, to the fumes of sulphur, becomes whiter than by any other process if alone used, and from French specimens I have seen a very fair white paper is made therefrom. Perhaps the aid of chloride of lime may have been used in addition in paper making.

For animal substances the latter material is not wanted. A simple exposure (in a vessel partially closed) to the fumes of burning brimstone is sufficient to give a beautiful white to parchment or vellum, and likewise to glue pieces, care being taken to apply the gas to the materials intended to be bleached, while they are in a wet state.

It is not a little surprising that the attention of manufacturers has so long been withheld from the bleaching property of brimstone when burning at a low temperature. Corn dealers and hop growers have long known its value. Brimstoned oats which smell of this material when improperly used are well known in Mark-lane.

The wet harvest we have had must be my apology for offering an idea I have long entertained, that a moderate sulphuring of masses of corn, by burning brimstone slowly under malt-kilns or hop-casts, would take off the mouldy smell and taste of it if badly harvested, and render it more fit for food. The fumes of sulphur thus imbibed are easily got rid, both as to smell and taste, if the process is carefully done and the sulphur *in body* not driven over into the corn by using too great heat.

The antiseptic qualities of sulphurous gas are undoubted, and the facility with which it may be removed from the substance acted upon renders it worth the trial to prevent the loss of ill-gotten corn, by checking the progress of mouldiness.

Δ

Sept. 30, 1839.

MR. HANCOCK'S STEAM-CARRIAGE JOURNEY TO CAMBRIDGE.

In consequence of an invitation which Mr. Hancock received from several influential parties in Cambridge, he per-

formed a demonstrative trip to that town with his common road locomotive the *Automaton* on Monday last. The *Automaton* is the largest steam-carriage Mr. Hancock has constructed; it was built in the year 1836, and ran successfully for some time on the Islington road. Two years' exposure to the weather in an open shed was not treatment likely however to improve steam-engine machinery; and although several short distances were lately worked by it, and it was thoroughly examined, a derangement or failure of some of the parts in a journey of 50 miles was no more than could have been naturally expected.

The *Automaton* ran from Mr. Hancock's factory at Stratford to Bishopgate-street in beautiful style. At the Four Swans it took up its company, amongst whom were Sir James Gardner, Mr. Snow of the Highgate-road trust, Messrs. Humphreys of Cambridge, several civic capitalists, and a new steam-carriage inventor, Mr. Hills of Deptford, who doubtless came to take a lesson from Mr. Hancock in the difficult path of enterprise he has chosen.

At about five minutes to ten o'clock, the steam-carriage left the Four Swans, and was beautifully steered by Mr. Hancock through the crowd of spectators, and the number of coaches, carts and waggons usually passing in the neighbourhood of Bishopsgate on a Monday morning. Notwithstanding a heavy luggage waggon blocked the way for some minutes, Shoreditch-church was passed at two minutes past ten. This is the spot from whence the miles are measured and the mile-stones placed. The first station for taking in coke and water was the Old Plough at Tottenham, a distance of 4½ miles from Shoreditch, which was ran in seventeen minutes. Ten minutes were occupied in taking in coke and water. The sixth mile-stone was passed in six minutes, (a mile and a half); seventh mile five minutes; eighth mile three minutes; ninth mile four minutes; tenth mile three minutes; eleventh mile four minutes. Near to the twelfth mile-stone, the stay of the blower broke, and after a stoppage of about ten minutes, the steamer proceeded to the second station, Cheshunt. The travelling time of the twelfth was about four-and-a-half minutes. An hour and five minutes were spent at Cheshunt, putting a temporary stay of hoop-iron to the blower. The thirteenth mile was gone over in seven minutes; fourteenth four minutes; fifteenth four minutes; sixteenth, three-and-a-half minutes; seventeenth, very hilly, five minutes; eighteenth three minutes; nineteenth, hilly, four minutes; twentieth and a half, to the Oak at Ware, seven-and-a-half minutes. Here the passengers lunching, the engineers dining, and filling tanks with water, occupied fifty minutes. From Ware the twenty-second and twenty-third miles of considerable incline, were done in six minutes each. The *Automaton* was now approaching its most difficult task, the ascent of Wade's Mill Hill, an incline nearly as great as Holborn Hill, London, with a soft bottom, and newly covered with loose gravel. It was confidently prophesied by several who hoped and wished otherwise, that here the steam would fail, and many had gathered on the spot to witness Mr. Hancock's success or failure. To the gratification of most and the astonishment of many, the hill was ascended beautifully; the two miles of incline (twenty-fourth and twenty-fifth from London) were done, the former in seven minutes and the latter in eight minutes. The twenty-sixth mile was done in three minutes; the twenty-seventh, to Puckridge, in four minutes. Here coke and water were taken in. From Puckridge to Buckland, the 7 miles were travelled at about 5½ minutes each, exclusive of various stoppages to cool the axles, which were now becoming extremely hot, by throwing water over them. From Buckland to Melborne, 8 miles, the rate was about 6 minutes a mile; from Melborne to Harston, about 5½ minutes a mile. In ascending Wade's Mill Hill the full power of the engines was of course exerted, and the force of the steam loosened the packing of the stuffing-boxes; a segment also of the ring of lead-packing between the flange of the cylinder, and its cap was blown out. These leakages of steam, and the clinkers which had gathered on the furnace-bars, and on the sides of the boiler-chambers, from the badness of the coke, had crippled the *Automaton's* power, so that the last 5 miles into Cambridge occupied nearly an hour. The average rate of travelling the first 30 miles was, exclusive of stoppages, nearly 12¾ miles an hour, and of the whole

journey, upwards of 10 miles an hour. The swiftest travelling was between Tottenham and Waltham, some part of which road was gone over at the rate of nearly 25 miles an hour. Down some hills was done at greater speed even than this, by mere gravity, the steam being completely shut off, and drags on—which strained the engine nearly as much as the ascent of Wade's Mill-Hill.

This steam journey, although it is one of the worst Mr. Hancock ever performed, will be the most useful to him. It will show him more of the difficulties likely to arise in common road steam traffic, than he has hitherto seen, and he will be enabled the better to avoid them in future, than had they not been experienced. Judging from this trip, it would seem that a greater distance than about 30 miles, should not be performed without either a change of engine, or at least of fire-bars. Lead flange packing should also be avoided, and some substitute for hemp packing devised for the piston-rod and valve-boxes. At Cambridge the cylinders were repacked with copper wire, a most effectual mode. The quantity of coke consumed on the journey was sixty bushels. The tolls paid amounted to 13*s*. 2*d*.

Since Mr. Hancock's previous steam travelling, a very considerable change seems to have taken place in the public opinion, as far as it can be judged of from a road-side crowd; instead of the hootings, hisses, and execrations which were bestowed upon him in his previous journies, he was greeted in his progress to Cambridge with applause and blessings and wishes for success.

The matter appears now to be taken up by parties likely to bring steam locomotion on common roads to a practical test, because it is their interest that it should succeed—namely, by the road trustees, inn, and coach proprietors. The *Automaton* was to remain in Cambridge for a few days, and to journey about the neighbourhood to demonstrate the practicability and advantage of this novel mode of transit. On Tuesday a party of gentlemen of Cambridge were favoured with a trip round Parker's Piece and the neighbourhood, and on Wednesday the *Automaton* was to make its appearance at the Newmarket race course.

MODE OF DISCONNECTING PADDLE-WHEELS.

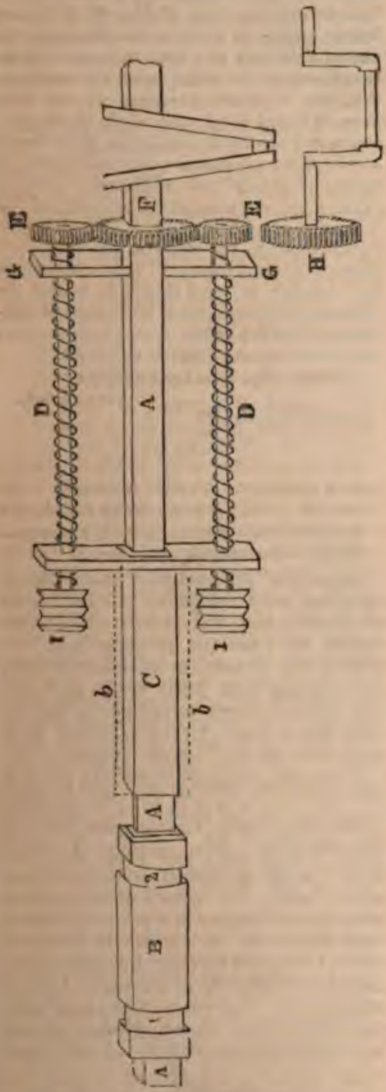
Sir,—Perceiving by the Report of Messrs. Pringle and Parkes in your July number, that an easy and rapid means of disconnecting the paddle-wheel of a steam vessel is still a desideratum, I take the liberty of sending you a plan for effecting the same, which, if worthy of notice, you will perhaps do me the favour to insert in your valuable work, of which I am a constant reader. The idea is original with me, but in this inventive age it is highly probable that I have been long since anticipated, and as "there is nothing new under the sun," I am quite prepared, for at least a dozen claimants if you should give it your countenance by inserting it in the *Mechanics' Magazine*.

I remain, Sir,
Your most obedient servant,
JOHN TALLERVEY, Lt. R.N.

Westbury on Tyne, Bristol, Aug. 22, 1839.

A A A, paddle shaft, which is to be square excepting at the bearings. B, barrel of paddle-wheel, from which the spokes are to radiate; 1 and 2 circular parts for bearings; this barrel to be square in the inside. C, another square barrel with flanged end, this barrel to fit on to the shaft and into B. D D, two screws, with toothed heads at E E. F, toothed wheel turning on paddle shaft and gearing into E E. G G, two bearings, or supports, attached to paddle shaft for screws D D to turn in; H, a moveable toothed wheel placed under paddle shaft to gear into and turn toothed wheel F; this wheel H to be worked by a winch (should the engine not be stopped at the disconnecting, H would gear into E E, equally well producing same effect.) I I, vessel's side for end of screws, D D, to butt against; *b b*, dotted lines, outline of B, and where it ought to be placed, but for the sake of clearness, all parts are stretched at a distance from each other. There is to be fixed a stopper for checking the wheel when intending to disconnect. The paddle-wheel being checked, and H put in gear and turned by the winch, will of course turn the screws in the holes in the flange of C, which holes, are of course to be tapped or threaded for the purpose, C will be drawn out of B, the ends of

DD merely butt against the vessel's side at II; when the wheel is disconnected the flange of C will be drawn close up to the supports GG. The reverse of this will connect, and H being



moved out of gear, the whole will revolve, occupying about the same space in height as the crank which will require *the deck to be raised at that part above the shafts. No bearings or framing* must come in the way between the gunwale and crank bearing, and the bearing of the shaft at the sponsing must be different and independent of that of the barrel of the wheel. The same effect may be produced and the wheel disconnected by threading the shaft and barrel C, inside, the engines would then disconnect by merely checking the wheels and removing a key necessary to secure C; but if the engines broke down, and you wished to disconnect, the shaft would then have to be checked, and the wheel turned; this could only be done by machinery, and would be difficult in bad weather. I have this plan sketched, but prefer the one sent.

J. T. Lieut. R.N.

THE "BRITISH QUEEN" AND "GREAT WESTERN"—MR. HALL'S CONDENSERS.

Sir,—Had it not been for a temporary absence from town, I should have taken an earlier opportunity of replying to the attacks of "Piston Rod" and "Bowsprit," in your 838th number, but "better late than never." I hope I am yet in time to request the insertion of a few brief remarks on the lucubrations of these gentlemen.

It may be held superogatory for me to add my testimony in corroboration of the fact that "Piston" and "Observator" are *not* "two single gentlemen rolled into one." Flattered as I might feel by being identified as the writer of the excellent letters which have appeared under the former signature, I need hardly tell you, Mr. Editor, that I can lay no claim to the distinction. It may be worth while, however, to remark on the slenderness of the evidence by which "Piston Rod" attempts to prove the presumed connexion; *i. e.*, the use of the word "again" by "Piston," when speaking for the first time of the *British Queen*. This would be very sorry circumstantial evidence at the best, but it is blown to the winds at once by a simple reference to the letter in question, when it appears that "Piston" *had* before alluded to the *British Queen*, (in the beginning of his communication), had diverged to another subject, and had only used this *important* word "again" on returning once more to the *Queen*, in criticising Mr. Hall's justly-styled "bold and inflated" letter on the wonderful powers of his condensers! The proof of all this is in the hands of every reader, and is contained within the compass of a single column of the *Mechanics' Magazine* (see vol. xxxi., page 324). After this, what are we to think of "Piston Rod" and his "proofs"?

The policy of the mode by which this individual endeavours to patch up the cause of his friends in the north, is excessively short-sighted. He would have us believe that the engines of the *Great Western* are in a most distressingly dilapidated condition, hardly able to hold together, and with their cylinders and pistons furrowed and injured most deplorably. But what then? These engines in this miserably worn-out condition (according to Piston Rod), were still able to beat the bran-new Glasgow-made ones of the *British Queen!* If this do not afford proof sufficient of the great inferiority of the Scottish engineers, what will? They could not surely have had a better chance of triumphing over their London competitors than this. According to our veracious informant, the condition of the "chef-d'œuvre of Maudslay and Field" is now somewhat similar to that of the high-mettled racer when reduced to the sand-cart; and yet (shocking to relate) the crack specimen of Scottish engineering, which he can never sufficiently admire, was *left behind out of sight* by this cripple, on the third day of their steam race across the Atlantic, and never more had an opportunity of seeing anything of the vessel propelled by the worn-out, ricketty, seriously-injured, but somehow quick-going engines of London manufacture!! Truly judicious is "Piston Rod's" observation that "well it has been said—'*Save me from my friends!*'"

My other antagonist, "Bowsprit," would be a formidable one, did it not happen that all his facts are fictions. I need only refer to any of the newspapers of 15th and 16th August for proof that, according to the American journals at least, the odds at New York were altogether in favour of the *British Queen;* and, as to the assertion that "the *Great Western* reached Bristol only about two hours before the *Queen* arrived at Portsmouth," I cannot guess the motive for putting such a transparent figment upon record. Any of the journals of the above date will bear witness to the fact that the *Great Western* arrived early in the morning of the *fourteenth* of August, and the *Queen* early in the morning of the *fifteenth*, the difference being *twenty-four hours* instead of *two*, as I thought was known to all the world, until surprised by "Bowsprit's" unaccountable and unfounded assertion to the contrary.

With respect to Mr. Hall, I cannot leave him in better hands than those of "Piston." However, I am tempted to ask him one question. It would refer to what, at first sight, seems a contradiction in certain passages of his two last letters; in one of these *(page 404) we are told that "there are injection condensers, as well as his own,* on board the *British Queen*, that of course the former required blowing-out cocks to be put to the boilers, and that the water" (on the voyage from Greenock to London) "was *blown out too low by* these cocks," from all which it would appear that the injection condensers were in operation on this voyage. Yet the express object of Mr. H.'s former letter (page 252) was to refute the erroneous notion that such had been the case, and on that occasion, in order to set all doubts at rest, Mr. H. observed emphatically "I have been on board during the whole of the passages, and positively assert that *not a single stroke* of the engines has been made, *except* by the working of *my condensers.*" What, under these circumstances, becomes of the "blowing out too low" story, by which the injury done to the engines on these self same "excellent passages" is *now* accounted for? bearing in mind that it is one of the distinguishing excellences of the patent condensers, that the boilers with which they are used *never require blowing-out at all!* *

I remain, Sir, most respectfully yours,

OBSERVATOR.

London, Sept. 25, 1839.

COL. MACERONI'S INVENTIONS—MR. HANCOCK'S STEAM-CARRIAGES—WOODEN PAVEMENTS—WATERPROOFING BOOTS—HALL'S CONDENSERS, &c. &c.

Sir,—The extraordinary prostration of body and mind caused by the *too sudden* dismissal of three ounces of laudanum per day for six years, has prevented me from offering my humble contributions to your valuable pages for many weeks past, save one which I am now sorry to have had the weakness to confer upon Mr. Walter Hancock about his *twelve* steam-carriages.

There are some little matters in your number of the 14th of this month, which maugre my *morbid* apathy, I am induced by the clamour of my "friends" to notice. First, there is much said about the "new light" on the advantages of *wooden pavements*, which, for recommending to the lieges of this country in a printed pamphlet, reprinted in the *Mechanics' Magazine*, in 1825, I was most severely ridiculed in the *Monthly Repository* of February, 1834 (I think). The first verses of the song which the editor of that clever periodical indicted in praise of my *wooden* plan, have already

* The boilers being supplied with "blowing-out cocks," put it in the power of any evil disposed person to open them, without there being any necessity for so doing. We need scarcely observe that there is no connexion between the engine and the operation of "blowing out," which, as "Observator" doubtless knows, is a manual operation performed at the discretion of the Engineer.—[ED. M. M.]

appeared in the *Mech. Mag.* But as many of your readers who now read in all the newspapers of the "patents," "contracts," "advantages," &c., which *I* set forth to the public, and you, Mr. Editor, approved of, fifteen years ago, I repeat this day the joke of the *Monthly Repository* for February, 1834; the writer supposing the inhabitants of St. Giles's holding out their dusky hands before a Christmas fire *made of the wooden pavement*, and singing a song of praise to me:—

> "London streets is paved with wood,
> Long live Maceroni;
> For we'll blow out with summut good,
> Saved out of our coal money."

Now, Mr. Editor, all originality about wooden pavements apart, as you have very sagaciously observed in your preface to my *Hints to Paviours*, the only way to form a firm and even sub-stratum for any pavement, either of stone or wood, suitable to *our* streets, with so many gas and water pipes, &c., is to be obtained and preserved by my very powerful mechanical flying stone driver, as you named it. Thus, I beg leave to tell all the dupes of the pretended wooden pavement projectors—first, that they have not a shadow of a claim for a patent; secondly, that their wooden blocks will no more keep their level than the stones, without the use of my machine to compress the sub-stratum, and then the blocks. Further, that I shall soon be in a position to contest the point with them, and beat them from the field, covered with ridicule. At any rate, the pages of your excellent Magazine must convince those who read them, that I have far more claim to some of the advantages resulting from improved paving, whether of stone or wood, than any other man existing. But for thirty years I have been "throwing pearls to swine," and preaching to the desert air, on many matters interesting to society!

Another thing I wish to notice, is the very astonishing discussion about "the patent of Mr. Hall" for condensing the steam escaping from the working cylinders and safety-valves of sea-going steam-vessels, by passing it through a cluster of small copper tubes, all surrounded by cold water, so as to return the *fresh* water to the boiler, and avoid any incrustation of salt. Now it so happens that in 1825 I assisted in the construction and application of similar condensing *fascæ* of copper tubes, at Mr. Gurney's factory in Albany-street, Regent's-park, which were applied by Messrs. Busk and Keene to three steam-vessels, which were sent to Bordeaux, to navigate the river Garonne, and the adjacent coasts. The fresh water was, and is now, *worked over and over again with* a very *small loss, and may be called distilled* water for months, no sea water being used, but that which is requisite to condense the waste steam, by being passed through the drums containing the clusters of copper tubes, which condense the steam.

I should not have spoken of Mr. Hall's "invention," had I not been on the point of making public use of this plan for some steam vessels I am about to build, furnished with my new patent absolute safety and extra powerful boilers.

By the by, I see in your number of the 14th instant, that one of wise men of "The British Association," a Mr. John Isaac Hawkins, illuminates the leiges with a discovery of the advantages of wooden pavements for streets, a subject which you, Mr. Editor, so ably discussed and approved of in remarking on my "Hints to Paviours," so far back as 1825! Moreover, I see in your No. of this day (Sept. 21) that a Frenchman has got the job of rendering hard and dry, the gravel of the Birdcage Walk, and the Parade in St. James's Park, by means of hot coal tar! Now *I* did this to Mr. I. R. Bell's garden walks at Blackheath, in 1816. I strongly recommended it in your pages in 1825; and in June 1838, I proposed the operation to Lord Hill, as may be seen in the *Naval and Military Gazette* of the 7th of July, 1838. In the same letter, I proposed to render waterproof and thrice more durable the boots and shoes of the troops, for sixpence a pair, by means of my simple fusion of tallow and resin, often spoken of in your and other useful periodicals, and so much approved of by your practical intelligent correspondent, Mr. Baddeley. Lord Hill addressed me the following reply:—

"Lord Hill has received Colonel Maceroni's proposals, but cannot give him any employment.

"Horse Guards, July 18, 1838."

Now a Frenchman is employed on the very same thing that I have practised and preached ever since 1816! I shall soon publish two other volumes of my memoirs, when it will be seen what numerous robberies have been perpetrated on my brains, both by private and public parties, in military and scientific inventions, or suggestions.

Amongst other piratical robberies I have suffered, is that of my waterproof percussion lock for artillery, the model of which I have left at your office, and should have long since have demonstrated to you, and assisted in its exhibition to your scientific readers, had not a rare combination of ill health, and other "untoward" circumstances caused delay and desperation.

In 1830, you published in your excellent journal my ideas on the identity of electricity, galvanism, magnetism and solar light;

two years after a man starts up, and strong in patronage and in place, proclaims and gets the credit of "his discovery"! In 1826 I published in your journal my plan of using a combination of coal tar and whale oil with small coal, or cinders for the use of steam ships, as producing more heat *in less compass*, than common coal or wood. *Now*, the very government have adopted this fuel, recently "invented" by somebody else!

Whatever merit or demerit may be due to Captain Ericcson's screw propeller for steam vessels, I have Admiral Sir Edward Owen's letters to show that I presented the models of the same thing in the year 1828.

In 1824, I presented to the Admiralty my plan of steam ships, shot proof *at the bows*, and a bulwark 8 feet high, armed with one or two guns to project *horizontally* 12 inch shells. At 1,000 yards not one shot in a hundred fired from a line-of-battle-ship, would hit the sharp prow of such a steamer, and all that did, would glance off without doing any harm to ship or crew, or paddle wheels. But the great broadside of the liner offers a vast and sure mark for the 12 inch shells, and above 20,000 square feet of canvas and tarred ropes, masts, yards, &c., for volleys of fifty of my *prehensible* naval rockets every minute. *Now*, they are arming war steamers with large bomb cannon; but we shall see what they will do against my rockets, which the late Sir Thomas Hardy, Sir W. S. Pechel, M.P., and other naval authorities have declared, "must put an end to all ships rigged in the present mode."

But it would be endless to enumerate all the labours that have been substantially successful, although fruitless as to *profit* to, Sir, your obedient servant,

MACERONI.

P.S.—The papers of this day (Monday, 25th September) announce that Oxford-street is to be paved with wood—so "long live Maceroni," as *The Monthly Repository* sung in 1834, and you in 1825! It will be "no go," after all, without my machine.

RECENT AMERICAN PATENTS.

[*Selected from the Franklin Journal.*]

STEAM ENGINES, *Nathaniel Bosworth, Philadelphia, July* 9.—The patentee says: "My first improvement consists in the manner in which I construct and set the boiler or boilers, and connect them with the pipes for the conveyance of steam, and the auxiliary parts of the engine. The boilers which I employ are of the cylindrical kind, and they are to be so set that they may be completely surrounded by the flame and heated air from the fire, and have their whole surface, therefore, converted into a fine surface, instead of exposing one-half only of the boiler to the direct action of heat, as is usually the case. These boilers, as they are to be entirely surrounded by the fire, are to be kept completely full of water, and are not subject, therefore, to burn out. They are to be so set as to form a considerable angle with the horizon, rising from their front towards their back ends about one inch in a foot, by which elevation the steam will be caused to escape readily from the boiler into the steam-chamber or receiver at its upper end."

"The steam-cylinder, with its stuffing-box and piston, has nothing in it peculiar, excepting the construction of the piston, which is made of metal, in one piece, and without packing; it may be formed of hard cast-iron or of cast-steel, and must be finished perfectly true and smooth. Its diameter is to be such that when its temperature is raised one hundred degrees above that of the cylinder, it will still pass through it readily, but leaving no sensible space between the two. When of the same temperature with the cylinder, it will of course pass through it loosely. Up to a diameter of four inches, I think it best to have the piston perfectly solid; but if above this size, it may be hollow for the purpose of decreasing its weight.

"Such a piston I have found to work without any apparent friction, beyond that which necessarily exists in the passing of the piston-rod through the stuffing-box; and the most careful observation leads to the conclusion, that there is not any loss of steam between the piston and the cylinder, and if there is any, it has been practically proved to be so small in quantity as to be more than counterbalanced by the decreased friction, and by the other advantages resulting from the improved construction of the engine." The valve is constructed with reference to a peculiar proportion of its parts, which is illustrated by a diagram; in its general construction it is nearly like some others; its peculiarities we cannot conveniently discuss in the space allotted to our animadversions. It is calculated to cut off at such part of the stroke as may be required.

To indicate the quantity of water in the boiler, a glass tube is used, as in some other machines, its upper end being connected by a pipe, with the steam chamber, and its lower end with the lower part of the boiler. It is placed at a distance of six feet from the boiler, and from this circumstance, and the arrangement and construction of the tubes, it will always remain cool, whilst it may be so situated as to secure it from the liability to be broken by accident.

"In my improvements, I have had in

view, mainly, to attain a higher degree of speed than has hitherto been thought eligible in the reciprocating engine. I have succeeded, in practice, in working the piston of my engine at a speed of upwards of two thousand feet per minute, and have thus produced effects at least five fold greater than have heretofore been produced by engines of the same weight. I am aware that I cannot claim the increased speed of which my engines admit, in the abstract, but I do claim it in combination with, and as resulting from, the manner in which I have constructed my engines, and especially from the peculiar construction of my piston, which moves, as I verily believe, absolutely without friction.

"I claim, therefore, the general combination and arrangement of the above described engine, taken as a whole, and as distinguished from other engines by appropriate characteristics. I claim the within described mode of constructing and setting cylindrical boilers. I claim the constructing of a metallic piston to move without friction in the manner set forth. I do not claim to be the first to have used a solid metallic piston, but I do claim to be the first who has used it so as to pass through the cylinder without friction, having been the first to ascertain that this might be done without a waste of steam. I claim the manner of constructing and using the receiver, where two or more boilers are employed, as herein fully made known. I claim the manner in which I have constructed my indicator, and connected and combined the same with the boiler, substantially as described. Lastly, I claim the particular construction of the slide-valve for cutting off the steam at any designated part of the stroke of the piston; this result being obtained by the particular proportion of its parts, without any greater complexity of construction than in the ordinary whole stroke valve."

We have made large extracts from the specification of this patent, because there are some things in it which are interesting and well calculated to arrest attention. Whether the experiments which were instituted on a large scale have been productive of new and useful results, we have not been informed, and are apprehensive, therefore, that such has not been the case.

Preparing Tannin, and Solutions of Tannin, from Astringent Barks; *Augustus J. Hayes, Roxbury, Massachusetts, July* 12.—"I place in suitable vessels, the contents of which can be heated by steam, or otherwise, the quantity, and kind of bark to be operated upon, after it has *been deprived of its out coat or ross*, and add hot or cold water sufficient to cover the bark. I then dissolve so much of the alkaline salts of either ammonia, potash, soda or lithia, or of these alkalies in a pure state, as may be required to neutralize four-fifths of the acid naturally contained in these barks, (which quantity varies according to the season of cutting the barks) in one barrel of hot or cold water, and mix the alkaline solution so obtained, with the bark and water, by strong agitation. I allow this mixture to remain one hour, and after that time, heat the whole to nearly the boiling point of water, then withdraw the heating source, and allow the clear liquor to drain from the bark. I wash the bark which remains with the weak liquors which have been used for washing other portions of bark, and mix the liquor which drains from the bark with that previously obtained, so long as it is denser than water; what remains is used for washing the next quantity of bark. If I operate without applying heat to the mixture, I allow it to remain for twenty-four hours mixed, instead of one hour, and then proceed as above described.

The solution of oak or hemlock tannin thus obtained, may be used for tanning operations generally, or for concentration, by which the watery part is dissipated by heat, and the bulk and weight greatly reduced.

If I operate on 128 cubic feet or 1122 lbs. avoirdupois, of dry hemlock bark, deprived of its outer coat or ross, I use and prefer, 11 lbs. of dry carbonate of soda, (called soda ash) or 16 lbs. of carbonate of potash, (called pearlash) although the alkaline bases of these salts, and other alkalies in equivalent proportions, will serve for neutralizing four-fifths of the acid naturally contained in that bark, and these are the mean quantities required. I then extract the tanning principle by the method described above, and if it is to be carried to distant parts, I concentrate it by boiling it in vessels of lead, tin or copper, heated below 300° Fahr., until it is reduced to the form of a consistent paste.

Gun Carriages for Naval and other Purposes, *William Smith, Washington, Kentucky, July* 19.—"The distinguishing character of this improvement consists in making about four-fifths of the periphery of each truck or wheel of the gun carriage, the figure of a section of a spiral curve, and the other fifth nearly flat, instead of a circle, for the purpose of retarding the motion of a carriage, as the gun recoils at discharging, and thus to prevent the breaking of the breeching, which often takes place when the trunks are made round." The sketch in the margin will give an idea of the intended form of the wheels.

To aid in training the gun for firing forward or abaft, anti-friction rollers are to be placed on the middle of the flat side of the periphery of the wheel, so that it may be moved laterally with but little friction on the deck.

MANUFACTURING SUGAR FROM BEETS, *Joseph Hurd, jun. Boston, Massachusetts, July* 26.—The beets after being taken from the ground, and freed from all extraneous matter, are to be cut into slices, the thickness of which should not much exceed the eighth of an inch. I have invented a machine for the purpose of performing this operation, which is more effective than any other with which I am acquainted, and for which I have obtained letters patent of the United States. The beets are to be taken out of the ground as soon as they are perfectly matured, and are to be then stored in a cellar or other suitable place, as otherwise they rapidly undergo a change unfavourable to the production of sugar; they are to remain in this situation until the arrival of the time for slicing and drying them. The proper period for this operation is the earliest season of frost; as, in my process, they are to be exposed to a freezing temperature, so as to freeze and dry them in the air immediately after they are cut. This freezing is an essential point in my process; this, together with the dispensing with the use of lime, and the producing of sugar without molasses, may be denominated its characteristic features. To dry the beets after slicing them, they may be spread out upon laths or upon netting or in any other manner in which they will be most completely exposed to the frost and to the wind; the desiccation, when sliced as above directed, requires but a short space of time, and is effected without injury to the saccharine principle. After being thus frozen and dried, the subsequent steps of the process may be performed at any time, as not the slightest injury will result from keeping the beets in a dry state for any length of time.

When it is desired to proceed to obtain the sugar from the beets immediately, they may be subjected to the freezing process only, then thawed, and submitted to pressure; they will then readily yield the greater part of their juice, which they would not have done if pressed prior to their being frozen. The pressed slices, with the residuum of the sugar contained in them, may afterwards be dried, and kept as food for cattle.

When the sugar is to be extracted from the dried beets, which may be done at any season, they are to be steeped in pure water, which will take up all the soluble matter, an effect consequent upon the change produced in the beet by freezing. The quantity of water need only be such as shall suffice to cover the beets, and may be about one-half of that which was lost in the process of drying. The soluble materials consist principally of the sugar, the mucilage and a portion of colouring matter. To free the sugar from the mucilage and colouring matter, I generally acidulate the water before pouring it upon the dried beets, by adding to it a minute portion of sulphuric acid; the quantity of this cannot be easily designated, otherwise than by observing that it shall be no greater than shall suffice to render the acid taste just perceptible. Sometimes I add the water alone, and after allowing a sufficient length of time for it to take up all the soluble matter, which may be from three to four hours when cold water is used, but a much shorter period will suffice with hot water; I drain off and press out the solution from the residual matter, and then add thereto the sulphuric acid as before directed. In the former mode, but little of the mucilage and colouring matter is taken into solution; in the latter, they are precipitated, or so far disengaged from their combination with the sugar, that they separate in the form of scum, and are readily removed when the liquid is boiled.

The liquid thus prepared, is to be put into a boiler, and placed over a fire, a portion of the white of eggs or other fining being added. When brought to a boiling heat, a scum will rise, which is to be removed after damping or taking the kettle from the fire, which is to be repeated as long as any scum rises.

The next operation is to filter the liquor through animal charcoal, (ivory or bone black.) A stratum of two or three inches in thickness will suffice for every useful purpose, when the previous preparation has been used as above directed. The sirop will come through perfectly fine, and nearly as colourless as water; there will however be a very slight yellowish green tinge, resulting apparently from the presence of a peculiar principle in the beet; this material separates when crystallization takes place; although its quantity is minute, and its weight scarcely appreciable, if left among the crystals, occasion an adhesiveness of the particles and

a tendency to deliquescence; it should therefore be got rid of, and this is easily effected. All that it is necessary is to pour a quantity of white sirop upon the crystallized sugar after it has been pressed, so as to moisten it throughout and then press it again. This operation requires but little time, and should be repeated until the sugar is fit to pack.

The evaporating of the water from the sugar, preparatory to its crystallization, may be in great part performed over an open fire without danger of injury; it may be completed by placing the evaporating pan in a vessel of water kept at about 150° of Fahrenheit's thermometer. When this is performed early in the season, or by taking beets which have been frozen and dried at the proper time, there will not be the smallest portion of molasses produced, the whole of the sugar being crystallizable. In very cold weather, a large part of the water may be removed in the form of ice, by allowing it to freeze, and much labour and fuel be thus saved.

When the clarified sirop is sufficiently concentrated, small brilliant crystals will appear upon the sides and bottom of the vessel, and a crust soon forms over the surface of the liquor; the crytals go on increasing in size, and that portion of the sirop from which the air is excluded continues in a perfectly clear and liquid state; but if the sirop be at this time stirred, it becomes opaque, and of milky whiteness; a deposition of fine white sugar then takes place, and whatever of impurity may have remained in the liquor will rise to the surface; this portion crystallizes more slowly than the other but by drawing it off, and again exposing it to heat, it will readily form good sugar.

CHAT MOSS-PEAT SOIL CULTIVATION.

We find that a good deal of misconception exists on the subject of the agricultural improvements upon that large tract of land called Chat Moss, so well known to all travellers by the Liverpool and Manchester Railway, and that in some cases these improvements are much over-rated, and in others somewhat under-rated.

This property consists of about 6000 acres, and it is divided into portions taking the designation of Worsley, Barton, Astley, &c. according to the respective townships in which the estates are situated.

One part of Chat Moss (Worsley Moss) consists of about 1500 acres, and is in the possession of Lord Fras. Egerton; another portion of it called Barton Moss, is in the possession of Mr. Baines, of Leeds, and consists of between a thousand and eleven hundred acres, and the other estates of the same kind are held by other persons, some in large and others in small portions.

A considerable part of Worsley Moss has been reclaimed by the noble proprietor or his predecessor, the Duke of Bridgewater, but we do not know exactly to what extent.

Barton Moss has also undergone considerable improvement, and of that we are better able to speak than of any other part of the land. About twenty years ago Mr. Baines directed his attention to this object, and his first operations were to drain the moss, and to plough, marl and manure the portion marked out for cultivation: he has also nearly surrounded the land with plantations consisting principally of Fir, Larch, Poplar and Beech, which all grow well in this soil. The progress of these improvements has not been rapid, but it has been steady; the construction of the Liverpool and Manchester Railway, while it considerably increased the value of the property, accelerated the progress of the improvements, and Mr. Baines's own improvements and those of his tenants now comprehended something more than five hundred acres. The effect has been that good crops of wheat and oats are now produced, with fair crops of clover, potatoes and turnips; and a dairy-farm has been formed here, including about forty head of cattle, which, after about seven years' experience, are found to thrive and milk well. The consequence of these improvements has been that while twenty years ago the estate did not yield provisions for a dozen individuals, it now supports several hundreds with the necessaries of life, and that number is every year increasing. Another beneficial effect has been to give employment to the principal part of the inhabitants of the neighbouring village of Irlam, which from having been one of the most poverty-stricken villages in the county, has become the residence of a comfortably-provided and contented peasantry *

The degree of success that has attended this experiment may lead to erroneous conclusions, which it is proper to guard against, particularly as many Irish and English landlords possessing land of the same description, have visited these farms with the hope of making similar improvements on their

* In Devonshire and some of the southern counties, it was stated in the House of Commons, that the wages paid to labourers in husbandry is only 7s. to 8s. a week. This was denied by Sir Thomas Acland, who said the wages amounted to 8s. or 9s. weekly; but in South Lancashire the regular wages to husbandry labourers is from 12s. to 13s. a week.

own estates. It must be borne in mind that Barton Moss is only seven miles from Manchester, where there is an unlimited supply of manure, and a never-failing demand for farm produce; that the Manchester and Liverpool Railway passes through the whole length of the estate, from East to West; that the navigable river Irwell runs parallel with the railway on the opposite side of the land, and that the means of drainage is complete, while the beds of marl are inexhaustible.

In all places where these advantages are enjoyed this kind of cultivation may be prosecuted with success, and on this account the whole of the six thousand acres we have mentioned will eventually be reclaimed; but without these, or similar advantages, we should hesitate to recommend the cultivation of peat soils upon a large scale.—*Leeds Mercury.*

NOTES AND NOTICES.

New Antarctic Expedition.—The following particulars relating to the Antarctic expedition, when on the point of sailing, we copy from the *Court Gazette*:—"Great ingenuity has been displayed in providing the means of taking and preserving whatever may be important to natural history. Walking sticks, not larger than those commonly in use, have been hollowed, so as to carry nets for catching insects. The ferule at the bottom is removed, and the nets are drawn forth ready for instant use. Spirits of wine, in bottles of all sizes, have been furnished to preserve the insects. Small conservatories are on board, which can be kept at any temperature, with a view of bringing home living plants; and long gauze bags, with mouths of common netting, will be drawn after this ship in certain latitudes, where small marine animals, not known to us at present, may possibly be found. Mr. M'Cormic, the surgeon, has a small printing-press with him. Should the vessels be ice-bound for a season, this will probably enable him to bring out the *Erebus Times*, daily or weekly."

The Iron Steamer, "Rainbow"—Sir.—Can any of your readers inform me what has become of the *Rainbow* steamer, built two years ago by Messrs. Laird, of Birkenhead, for the General Steam Company? Last year she made several remarkably quick passages to Antwerp, but now we hear nothing of her. There was some talk of her owners having been paid not to run her, by the opposition company;—if so, why is she not on some other station? Is her construction bad? W.

Scientific Associations.—We are glad to observe that Associations, similar in character to the British Association, find increasing favour on the Continent. A preliminary meeting of the naturalists and physicians of the north has been lately held at Gothenburg, for the purpose of establishing a like society, to be called the Scandinavian Association. Eighty-one scientific men assembled on the occasion, of whom fifty were Swedes, twenty-one Danes, and ten Norwegians. The Bishop of Agard was elected President, and Professors Schoum, and Halst, and M. Fahraus, Secretaries, and representatives of the three nations present. A council was then appointed to draw up a code of laws for the future government of the Society, which is to hold its first meeting, next year, at Copenhagen, and of which Messrs. Oersted and Schoum were chosen Presidents.—*Athenæum.*

Necessity of Investigations in Acoustics.—Sir,—The report recently made to the Commissioners of her Majesty's Treasury by Messrs. Barry, De La Beche, W. Smith, and Charles H. Smith, on the sandstones, limestones, and oolities of Britain, forms with the numerous tables and results of experiments by Messrs. Daniell and Wheatstone appended to it, one of the most valuable contributions to architectural science that has been made in modern times. One hundred and three quarries are described, ninety-six buildings in England referred to, many chemical analyses of the stones given, and a great number of experiments related, showing among other points, the cohesive power of each stone, and the amount of disintegration apparent when subjected to Brard's process. It offers in consequence materials for deductions of great practical importance beyond those made or required to be made, in the body of the report, and will lead, I hope, to the publication of a comprehensive treatise on the subject by competent hands. This being the case then, it must, I think, seem desirable to all, that government should continue the good work they have so well begun, and that this report should be but the commencement of a valuable series; and I would venture to suggest touching the next step to be taken, the importance of appointing a committee to inquire into the most desirable forms of buildings and the best mode of construction, in a phonocamptic point of view, to investigate the science of sound and to deduce principles to be hereafter applied in the erection of buildings. On this subject, which is of the most vital importance to the excellence of new houses of parliament, we are confessedly entirely ignorant, (and I speak not of architects *alone*,) we do not know so much as would enable one to say *with certainty* before a building be finished, whether or not it will be well adapted for oratorical purposes. Even in churches and other edifices where the voice is to issue invariably from one spot, many circumstances at present beyond our reach because not fully understood, may have the effect, and every day do have the effect of preventing persons in certain positions from hearing; but in an apartment where, as in the House of Commons, individuals will arise from all parts indifferently to address the meeting, the difficulties become much more numerous, the probability of failure in some one respect or another, is necessarily much greater. Sincerely therefore do I hope that a commission will be immediately appointed to collect information on the subject, and conduct a series of experiments on a large scale, without which, nothing effectual can be looked for. Independently too, of the immediate occasion for this inquiry, the mass of facts that would be collected and the truths obtained, would be a great boon to the profession at large, and could not fail to produce most advantageous results.—I am, &c. GEORGE GODWIN, JUN.—*Civil Engineer and Architects' Journal.*

Daguerre's Photogenic Process—Erratum.—Page 466, lines 16 and 17 of second column, for "diluted acid already mentioned," read, "nitric acid diluted with water in the proportion of one part of acid to five parts of water."

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine *Office, No. 166, Fleet-street.*—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 844.] SATURDAY, OCTOBER 12, 1839. [Price 3*d*.

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CAPTAIN CARPENTER'S VESSEL PROPELLERS.

Fig. 2.

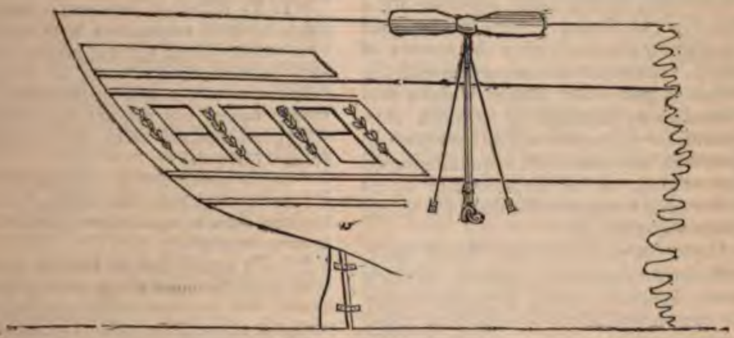


Fig 3.

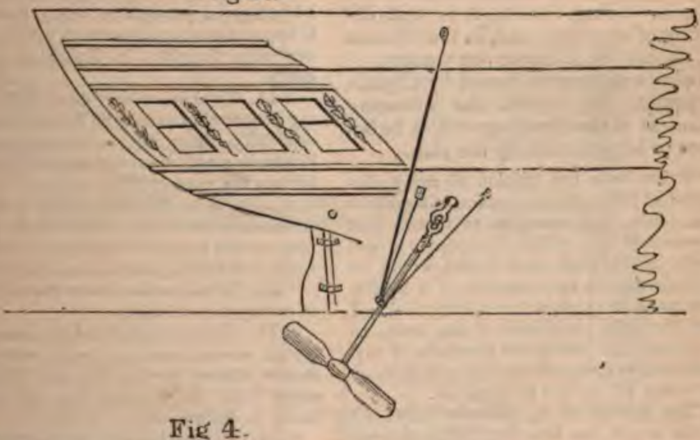
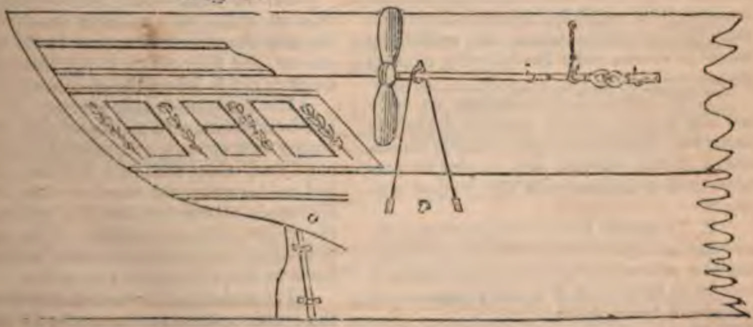


Fig 4.



CAPTAIN CARPENTER'S VESSEL PROPELLERS.

A vessel-propeller, the same, except in point of position, with that which is the subject of the present article, was brought before the public about a twelvemonth ago, having been patented by a Mr. J. J. O. Taylor. The extravagant statements put forth as to the powers of Mr. T.'s invention in comparison with the common and other paddle-wheels, prevented many from giving it much consideration—a glance being sufficient to convince any one at all acquainted with the subject, of the impossibility of its performing a tithe of the duty for which credit was claimed.

Capt. Carpenter, of the Royal Navy, subsequently improved upon Mr. Taylor's plan. Instead of one propeller under the dead wood of the vessel, Capt. Carpenter employs two, one on each side, near the stern. In this form, and as an *auxiliary* power to that of the wind and sails for sailing vessels, it is well deserving of attention, and, in that character, we now lay it before our readers.

From a prospectus issued by Captain Carpenter, we extract the following statement of the advantages which he believes to be possessed by the plan.

"It has been the opinion of many distinguished naval officers, captains of merchant ships, pilots, and scientific engineers, that the principle upon which I propose to propel vessels, as exhibited on a model, would be of infinite service to navigation, if a similar effect could be produced on a large scale; I have, therefore, considered it my duty, as the subject lies within the precincts of my profession, to demonstrate that principle, so that it may not be lost to mankind.

"The *Euclid*, an experimental vessel, 69 feet in length, has been fitted with this apparatus, from which it can be clearly proved that the propellers would be essentially useful to vessels under the following circumstances:—

"1. To vessels that are tacking or veering in a narrow channel, amongst dangerous rocks and shoals, with light variable winds, and a strong current, and require to perform their evolutions with the greatest certainty.

"2. To vessels that are becalmed near the entrance of a port, and are desirous of coming to a safe anchorage before dark, and only require to be propelled a short distance to accomplish their object.

"3. To keep vessels clear of their anchor.

"4. To assist vessels in casting or winding, and backing astern.

"5. To enable a vessel to be steered independent of the rudder, should it be disabled.

"6. To assist vessels out of a dangerous position, should an accident occur to their masts or sails.

"7. To Indiamen, transports, emigration ships, or other vessels that have many persons on board, this novel apparatus will afford the crew an opportunity of being usefully employed in propelling the vessel a-head during calms, and prevent that monotony, delay, and expense, which ever accompany distant voyages.

"8. To vessels that are trading on coasts infested with pirates, and require, in a calm, to direct their broadside towards the enemy, to keep them off.

"9. To vessels that are trading up rivers, such as the Gambia, where manual labour is cheap, and tedious calms are prevalent, when the use of the propellers would shorten the passage (probably many weeks), and be of great advantage to the owners.

"10. To ships of war, in taking up an advantageous position in action, particularly if opposed to steam frigates in a calm, or concentrating their fire in breaching a fortification.

"11. To ships of war, fitted both for sailing or steaming as may be deemed necessary, especially those that are stationed in a blockading squadron, and are required to intercept the enemy, if they attempt to escape in a calm, or in the event of the wind being favourable, possessing the means of topping up the propeller immediately out of the water, and making sail to economise their fuel.

"12. To yachts that desire the means both of sailing and steaming.

"13. To iron boats fitted for transporting troops across rivers or lakes, worked by manual labour, keeping the men safe under cover from the enemies fire, till they are ready to disembark.

"14. To canal-boats for navigating in shallow water, and amongst weeds, where the propelling blades require to be readily cleared, and their action in the water directed so as not to injure the embankments.

"15. To steam-vessels generally, that desire to do away with paddle-wheels, and to supply their place by a more safe and effective apparatus, that will give the same speed, and not incumber the vessel or alter the present mode of construction, that will remove the weight and inconvenience of the paddle-box, afford more room on deck, and allow boats to come alongside with safety.

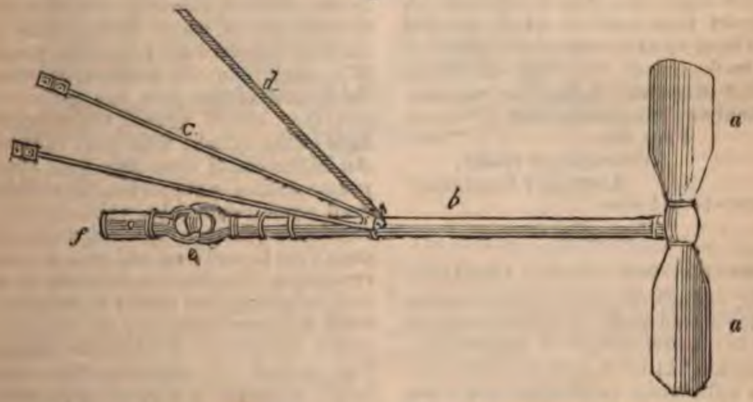
"The novelty of the invention consists in the position which has been selected for applying this peculiar propeller, and the manner

in which it is affixed to a vessel so as to render it practically useful."

In thirteen out of these fifteen "circumstances," we think that Capt. Carpenter's propellers would be useful auxiliaries. To the fourteenth and fifteenth, it appears to us they could never be advantageously applied. In canals (to mention one objection on this head) where the water is generally shallowest, viz., towards the sloping banks, it ought, to allow of this propeller being properly effective, to be the deepest. As to its application to steam-vessels generally, as a substitute for the paddle-wheel, we need only point out that the power is communicated to the propeller by a universal joint, and that the propeller acts at a considerable distance from any solid bearing, to convince marine engineers of the inapplicability of the plan.

A model of a steam-boat, fitted with this apparatus, has lately been exhibited working on the canal of the Polytechnic Institution. On this toy-like scale the plan works beautifully, but the idea of forming a judgment from such an exemplification is out of the question. A vessel suitable for canal navigation, we are informed has also been constructed, called the *Aerolite*, of the following dimensions, viz: length of keel, 65 feet; draught of water with engine on board, 2 ft. 2 in.; extreme breadth, 8 ft. 11½ in. The prospectus states, that "the efficacy of this principle of propelling has been well tested by manual labour, in this vessel, on the Thames, and on the City canal." We have not, however, been favoured with any statement of the experimental working of this "test," which would have given better data for observation than the action of the Polytechnic Institution model.

Fig. 1.



Description of the figures.

Fig. 1 is a view of the propeller; *a a*, the blades; *b*, shaft; *c*, iron brace; *d*, topping lift; *e*, universal joint; *f*, inner part of shaft.

Fig. 2 (front page) shows the position of the propeller when "topped" up, ready for immediate use.

Fig. 3 shows the position of the propeller when the vessel is in the act of being propelled.

Fig. 4 shows the position of the propeller when the vessel is at sea, and under sail.

The mode of communicating the power is not necessary to be shown; as that will vary according to circumstances.

ON ATMOSPHERIC ABSORPTION—SINGULAR SUBSTITUTE FOR CHURNING.—BY SIR ANTHONY CARLISLE.

Sir,—I submit to your numerous readers a *few observations upon one of the properties of water, which* may lead to many practical and scientific improvements, particularly in the construction of hygrometrical instruments.

The desiccation of many crystallized salts, for example, sulphate of soda, in a dry atmosphere, happens both at high and low temperatures, and, in either case, the transparent solid crystals, become a dry opaque powder. A remarkable instance of this kind also occurs if cream be frozen into thin sheets and exposed to a dry cold atmosphere, about zero, when the whole of the water of crystallization vanishes, and leaves a fine powder of dry curd and butter. This process is adopted in the higher Swiss Alps, where perhaps churning is found to be impracticable, by placing sheets of iced cream perpendicularly in a frame, like a plate rack, between two open windows, the desiccated cream falling down into a receiving dish, and forming a delicate substitute for butter.

I have often noticed the rapid disappearance of snow during a dry *black* frost, and this seems to depend on atmospheric absorption, for it occurs during the night more than in day light. A fallowed field shall be wholly covered with snow so as to conceal the colour of the earth, and in one night of intense frost it disappears before the morning, without any intervening thaw.

I am, Sir,
Your obliged reader,
ANTHONY CARLISLE.

Langhorn-place, London.

IMPROVED MECHANICAL AGITATOR.

Sir,—Much diversity of opinion exists in the political world, as to the *utility*—as well as the best method of *conducting*—"agitation." I trust, however, that few persons will venture to question, much less deny, the value and importance of *agitation* in the perfecting of many useful arts and manufactures; but for some most ingenious applications of this principle, I fancy I should hardly have obtained the *paper* whereon to write this communication, nor the little steel instrument with which it is penned. Now without the slightest wish to interfere with, or to rival Dan. O'Connell, Esq., M.P., the most celebrated *agitator* of the day—yet, have I, like him, been endeavouring to introduce "an improved system of agitation."

The accompanying camera-lucida *sketch, represents* a "mechanical *agitator," or "shaking machine,"* which I designed between two and three months since, for a steel pen manufacturer. The action of the machine has been much admired, and it has been applied to some other useful purposes, besides that for which it was originally intended. In the manufacture of steel pens, there is always a slight bur raised on the edges of the metal, by the cutting-out process; in the subsequent operations of annealing, hardening, tempering, &c., the surface becomes scaly and discoloured, all which defects are very conveniently removed by shaking the pens together in large quantities; the effect being assisted by the presence of some abraiding substances, as sand, ashes, sawdust, &c.

The old method of accomplishing this object was, by placing the pens and the polishing materials in a bag, and shaking them for an hour or two; this, though a tolerably efficient, was nevertheless a very tedious operation, and it was soon superseded by a metallic cylinder or barrel, mounted upon two horizontal guides, which it was made to traverse backward and forward by means of a crank. In this machine, however, the motion of the pens was too rapid, and they struck against the alternate ends of the cylinder with great violence. An improvement upon this rude apparatus consisted in supporting the cylinder itself upon two cranks, which caused it to take an oval path, by which means the pens were turned over and over at each revolution. The extreme difficulty, however, of getting two cranks so accurately made as to work smoothly and evenly together, induced me to adopt the following method of obtaining the same beneficial results in a more simple manner.

In the accompanying drawing A A represents a cast iron frame; B, is the cylinder (of tin plate) for holding the pens, &c., furnished with an opening at the top, closed by a screwed cap. Two iron rings, one at either end of the cylinder, terminate on the under side in square eyes, through which the bar C is inserted; this bar is prolonged to *d*, where it is connected with a crank, *f*, on the pulley-shaft, *e*. The bar C is pivoted on the top of a forked shaft or inverted pendulum, *g*, which moves upon two centres at the lower part of the frame, *h*; I is the driving wheel, a belt from which passes round the pulley, e, and gives

motion to the crank, f; K, is a fly-wheel; L, the handle. On turning the handle, the cylinder partakes of the motion of the crank, and also of the vibratory movement of the pendulum, which causes it to describe a curve resembling the

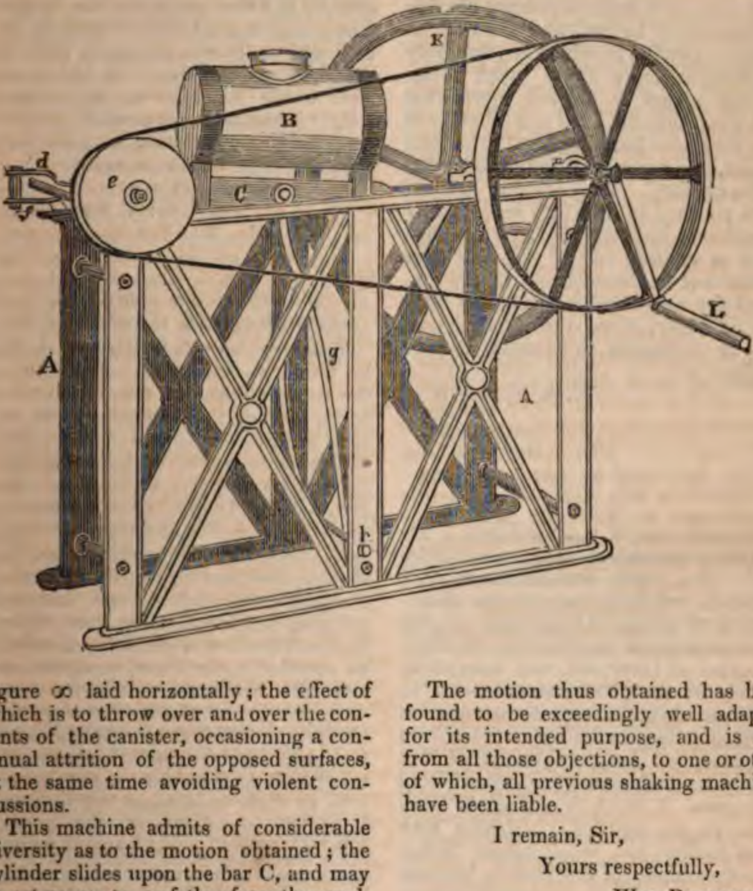


figure ∞ laid horizontally; the effect of which is to throw over and over the contents of the canister, occasioning a continual attrition of the opposed surfaces, at the same time avoiding violent concussions.

This machine admits of considerable diversity as to the motion obtained; the cylinder slides upon the bar C, and may be set nearer to, or father from the crank at pleasure. The attachment of the pendulous support is also variable.

The motion thus obtained has been found to be exceedingly well adapted for its intended purpose, and is free from all those objections, to one or other of which, all previous shaking machines have been liable.

I remain, Sir,

Yours respectfully,

WM. BADDELEY.

London, Sept. 9, 1839.

MINAS NOVAS FOR MICROSCOPES.

In the *Mechanics' Magazine* for September 29, 1832, No. 477, is Mr. Pritchard's very interesting account of his diamond lens for microscopes. It appears that the first he ground and polished was found to possess flaws which rendered it useless, and that having prepared others, several of them gave a *double or triple image; of course* they were also unfit for magnifiers. Experiments of this sort are very expensive when they fail of producing the anticipated result. The diamond lens, it seems, has only one-ninth of the aberration of a glass of equal power and aperture, but possesses three times the capacity for magnifying. This advantage is so important that I would recom-

mend Mr. Pritchard to try the *Mina Nova*, a stone next in hardness, I believe, to the diamond, and obtainable in the Brazils for comparatively nothing. Some years since, I brought a quantity of them to England to be cut, and the first lapidary in London informed me, that only his diamond lathe would touch them. At that period he did not know what they were, nor did I tell him; but since then they have been imported from time to time, and are now readily procurable in this country. They are very brilliant when polished and the rays are perfectly colourless, which may be an advantage when so applied. At all events, if they should not be found equal to the diamond for microscopical purposes, they will be likely, from the regularity of their crystallization, to be much superior to glass.

W. A. KENTISH.

SAND FOR THE MANUFACTURE OF GLASS.

Sir,—In one of your numbers I observed an account of some experiments made from sand, brought from New Holland, and used here in the manufacture of glass. A few bags of this silicious material were, on one occasion, imported at Liverpool, and bought up eagerly by the glass manufacturers, in consequence of its superiority over all other descriptions hitherto known in this country. I saw a specimen of it at the time, which certainly appeared to be very pure. A much finer kind, is however, in my opinion, obtainable with great facility and much nearer home. When in sight of the Brazils, between the latitudes 9° and 13° south, a passenger, on catching the first glimpse of the coast, invariably exclaims, "what an immense quantity of white linen is extended all along the shore!" or something to this effect. When he is assured that it is *sand* which has deceived him into this impression, he is credulous, until the nearer approach of the vessel confirms the fact. Now, as many hundred cargoes of cotton are forwarded from the Brazils yearly to England, this sand might be brought as *ballast* at a very trifling cost and sold here to considerable *advantage*. *Parties interested* in shipping have only to give instructions to their houses there to procure and place it in depôt, ready to be taken on board instead of large stones, which are frequently had recourse to for the purpose. These cost a good deal to ship on that side, and no little to unship on this, and are then unprofitable. Whereas, the *sand* would be likely to pay a good freight home, and may possibly, in addition, leave a larger profit to the shipper than any other article on board.

Yours respectfully,

W. A. KENTISH.

A TREATISE ON THE BOX OF MATHEMATICAL INSTRUMENTS.*

This, as an elementary work will be found an invaluable acquisition to the young student at school, as well as to the mechanic and engineer. It contains a minute explanation of the nature, use and construction of the various lines marked on the protractor, plum scale, sector and slide-rule, adapting them to an extensive course of linear, superficial, solid, and angular mensuration. Including practical geometry, surveying, measuring of timber, cask and malt gauging, heights and distances, falling bodies, vibration or pendulums, weights of persons, cattle, water, minerals, metals, balls, shells, &c.

In the preface the author very justly observes, "The instruments whose uses it explains, are often so little understood, that nearly half of them are of any service to their possessors. The sector, the most important in the box is generally regarded as unintelligible. The slide-rule is briefly noticed in some treatises on mensuration, but as the pupil is presented with only a few formal precepts *how* to use it, without knowing *why*, he never understands its nature, nor the method of determining the value of any result, and he therefore lays it by with disgust.

"In the present work, every thing relating to the numbers is explained, their nature, construction and the mode of ascertaining their values, the method of obtaining the gauge points is also shown.

* By Mr. T. Kentish, published by Relfe and Fletcher, 17 Cornhill.

By investigating and constructing them for himself, the student will be enabled to form others, as occasion may require, and thus put himself in complete possession of the science of instrumental computation. The uses of the parallel ruler are inserted simply for the purpose of including the usual problems in practical geometry."

The difficulties and drawbacks which the author describes are but too frequently experienced, and are a serious impediment to improvement, but throughout the whole of the little treatise of a hundred pages, his explanations are so clear and simple, that a pupil of any age will easily be taught to comprehend and to go through all the problems, which the work contains. As such, its peculiar merits recommend to general attention.

ON THE ACTION OF THE CRANK IN STEAM-ENGINES—PLAN TO SAVE PART OF THE SUPPOSED LOSS.

Sir,—In your Magazine, No. 841, you have inserted my letter about the action of the crank in steam-engines; I hope it will contribute to spread the old mathematical truth, that the actual crank, *prevents half the power*, of which the working steam in the cylinder is capable, being transmitted to the axles, *as rotary power*. Now, in practice, *the rotary power with which an axle is provided*, is indeed the only thing which propels a steam-vessel or a steam-carriage. It ought also to be the main object worth considering in those engines.

Everything has been tried to obtain the utmost quantity of power of which a steam-engine is capable. Some have perfected valves, others produce a better vacuum, &c. &c., because it enables an engine to perform with more effect. The boilers have been, and are till now, the principal point to which inventors have applied thier skill to create more and more power; and when summing up all those steps made since Watt, we compare the effects of the actual engines, with the old ones, we behold a most admirable improvement, and see wonders performed by them, of which, in the days of Watt, no one could have dreamed. Steam-vessels are crossing regularly the Atlantic; steam-coaches on railways are running with velocities of nearly fifty miles; and some prospectuses lately published, proclaim, that by acquiring some more power in improving certain boilers, steam-coaches on common roads *will run regularly, and give large profits.*

That steam-coaches will run on every good common road of Europe, is a very probable fact; collision on railways, and on the common roads, occasions, certainly, a great number of breakages of wheels and axles, and other bearings in the carriages; but greater difficulties have been overcome by the perseverance of men. *Three* trials are preparing at this moment, it is said, in a masterly style, to introduce the steam-coaches on common roads. These useful, novel, and most profitable attempts, when they will have their possible perfection, deserve, perhaps, more sympathy from an enlightened public, than it has been their lot to experience.

If the same power, since the time of Watt, has been the means to do so much more than in his days, will every invention which shall remove the heavy loss of fifty per cent., occasioned by the use of the crank, not enlarge the circle of wonders we have shortly indicated here, and extend steam navigation and steam locomotion of every description?

Scientific men have been aware of the importance of this point. The number of costly trials already made in rotary engines, proves that from Watt, who tried the first one, till now, they know well the value of any plan to set the crank aside. But, unfortunately, *all* the rotary engines have proved, in practice, to be failures.

I have tried it in a manner not attempted till now; I say so, although I am well aware of some patents taken out to improve the crank.

With reference not only to the existing cylinder engines, but concerning *all* the inventions made and employed till this day, I have found a manner to bring nearly thirty per cent. more rotary power on the axles, thnn can be done now; and I use no levers, and no toothed wheels.

Those who may be convinced by my two letters, can command a sufficient sum to realize this, and are willing to do so, may apply at my direction; if by letter, post paid.

I hope, Sir, you will insert this letter in your Magazine; if it only brings the public mind upon this very important side of the steam-engine question, it will be worthy to be introduced to the public by your periodical print; and I will be content if any one, by this your valuable publication, get the best of my start.

I am, Sir,
With true consideration,
Your devoted servant,
A. Gordon.

18, Finsbury-street, London, Sept. 23, 1839.

THE CALCULATOR—NO. 5.—LIST OF LOGARITHMIC TALES PUBLISHED

It is proposed to give a continuation of the list of portable logarithmic tables, printed in vol. xiv, p. 136.

8. Wallace's Mathematical Calculator, 18 mo., (this work is described in *Mech. Mag.*, vol. xxi, p. 376.)

9. Young, (J. R.) Mathematical Tables, 12 mo., London, 1833, pp. 164. *Contents.* 1. Logarithms of numbers to 36,000 to 7 places, with diff. but not prop. parts. 2. Log., sines, and tangents, to 7 places, with diff. for each second in the first and last two degrees, and for each minute of the rest of the quadrant. 3. Natural sines and tangents to every minute.

The type of these tables (nonpareil) is too small, the white lines too narrow, and other typographical defects materially lessen the utility of the volume.

10. Logarithmic and Trigonometric Tables, small 8 vo., London, 1836. This is a reprint of Professor Haisler's, but the type is neater and more distinct; and the volume is every way worthy of general patronage.

11. Logarithmic Tables of numbers, sines, and tangents, 18 mo., London, 1838. A reprint of Lalande's pocket tables, to 5 places of figures, with some additions. It is published under the direction of the Society for the Diffusion of Useful Knowledge, and the type adopted is the old fashioned brevier used in the early editions of Hutton, being far more distinct than type of modern cut.

It may not be amiss to mention that the Society has now in the press, in small 8 vo., a volume of tables of squares, cubes, square roots, cube roots, and reciprocals of all numbers up to 10,000. It is a re-impression of the principal portion of Barlow's tables (1814) now out of print—and the size would admit of its being annexed to the volume, No. 10 of this list.

J. W. W.

October 7, 1839.

Pocket Slide Rule.

I have caused Mr. Rooker to construct an 8-inch rule with one slide only, by which a great many of the objects of my "*Pocket* Calculator," may be answered. *The special scales for the back of the slide and the groove,* may be selected to suit the wishes of the owner. The rule is not more than one-eighth of an inch thick, so that it may be carried in a pocket-book.

J. W. WOOLLGAR.

ACCOUNT OF THE CROTON AQUEDUCT FOR SUPPLYING NEW YORK WITH WATER.

We extract from the *New York Weekly Herald* the following account of the Croton Aqueduct, one of the most stupendous works of modern times, now in progress in America. It is designed to convey a supply of pure water to New York; it has been four years in progress, and is expected to be completed in about two years.

The Croton Aqueduct, the noblest work of art undertaken in modern times, extends for 42 miles across a country, on the east bank of the Hudson, that is exceedingly rocky, hilly and uneven, and broken at short intervals by deep ravines, containing water courses running into the North river, besides innumerable roads, lanes, and turnpikes traversing the country in every direction. The whole line of the Aqueduct is divided into 96 sections, which have been contracted for by about forty eight firms.—The first section commences with and includes the dam about eight miles from Sing Sing, (where the Croton river is dammed back for more than five miles,) together with a small piece at the commencement of the aqueduct. The last section of the aqueduct proper terminates about 144th street, where the receiving reservoir is to be situated, and which is to occupy thirty acres of ground. The water is then conveyed down to the distributing reservoir, placed between 40th and 42 streets, on Murray Hill, (which covers less than ten acres,) in two sets of three iron pipes in each. This reservoir is 114 feet above tide water; and hence the water is to be conducted through the city in pipes at the expense of the corporation. The line of this distributing reservoir will cut the cupola of the City Hall, and therefore water can be thrown in the city that height.

The whole cost of the works, according to the contracts, including that for the low bridge at Harlem (the first plan) is 8,500,000 dollars; and now an additional 400,000 dollars is added for the high bridge, the contracts for which are to be completed the 29th of this month; making, according to these estimates, a little than 9,000,000 dollars, exclusive of the pipes from the distributing reservoir. There is little doubt,

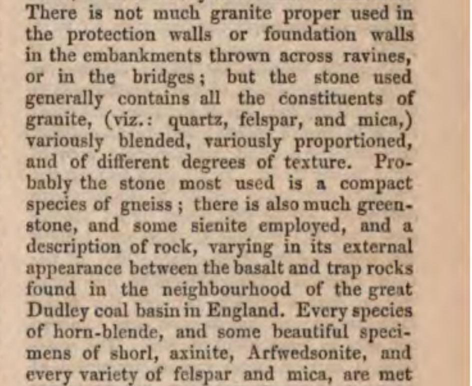
however, in the minds of the contractors that, before the water is delivered in the houses of our citizens, the sum of at least 12,000,000 dollars will be expended on the work. The low bridge was estimated to cost 450,000 dollars; the high bridge, 850,000 dollars, and the tunnel under the river, (the entire breadth of the stream, and not merely the channel,) differing from the Thames Tunnel by being worked through a coffer dam, was to cost 350,000 dollars. The whole of the iron pipes to carry the water across the river have been constructed for by Mr. Gouverneur Kemble, for 350,000 dollars.

The water is to be carried over Harlem River in two three feet pipes at present; which it is thought will suffice to supply the city with water for fifty or one hundred years to come, when they are to be taken up and replaced by four feet pipes. The high bridge will be composed of fifteen arches, eight of eighty feet span, and seven of fifty feet span. The aqueduct, where it crosses the Harlem River, will be very nearly one hundred and twenty feet above the level of tide water. At the dam above Sing Sing, the surface of the water is forty feet above the original surface of the river, (which rises in Putnam County, and has several sources from ponds and small lakes in the mountains,) and the bed of which has an average width of one hundred and fifty feet. The grade of the aqueduct at the dam is one hundred and sixty-six feet above tide water at New York, and the surface of the dam is twelve feet above the grade of the aqueduct. The pond of water caused by the dam will cover more than four hundred acres of ground; and the water will enter the aqueduct at the dam through a tunnel one hundred and fifty feet long. When the aqueduct is full, the water will move through it at the rate of nearly two feet a second, the conduit having an uniform descent of thirteen inches to the mile, from the dam to the distributing reservoir: where it will be able to discharge forty-nine and a half millions of imperial gallons of water every twenty-four hours. And calculating that every man, woman, and child in this city will each consume five gallons of water every twenty-four hours, (a fair estimate) the aqueduct can supply a population of ten millions, or more than the island of Manhattan will contain at the day of judgment.

Along the entire line of this truly noble work, *the hydraulic cement is exclusively employed.* This is obtained from different parts of the state, along the river and is made from a species of subcarbonate of *iron, which is found in a state of close mechanical mixture with sulphate of* lime, magnesia, and a small portion of silex. This stone when found is burned, like common limestone, and then ground instead of being slacked with water, put in barrels, and carefully excluded from the air; and none is allowed to be used that has been ground more than a month.

The quantity of brick used along the line may be estimated from the fact, that about 2,000,000 are required to form a mile of the aqueduct, making a total of about from 85,000,000 to 90,000,000 of brick for the entire work. The other description of material used for the bridges and arches, is of course found in the immediate vicinity of the works all along the line, either in large detached masses of rock, variously constituted, or in the body of the hills themselves. There is not much granite proper used in the protection walls or foundation walls in the embankments thrown across ravines, or in the bridges; but the stone used generally contains all the constituents of granite, (viz.: quartz, felspar, and mica,) variously blended, variously proportioned, and of different degrees of texture. Probably the stone most used is a compact species of gneiss; there is also much greenstone, and some sienite employed, and a description of rock, varying in its external appearance between the basalt and trap rocks found in the neighbourhood of the great Dudley coal basin in England. Every species of horn-blende, and some beautiful specimens of shorl, axinite, Arfwedsonite, and every variety of felspar and mica, are met with in blasting the rocks between the dam and the receiving reservoir.

The nature of the work of the aqueduct to contain the water may be gathered from the following diagram, which is an exact representation of the masonry in all the open earth cuttings:—



The dotted lines at the bottom of the diagram represent the boundaries of the concretion of the foundation wall. The dotted line marked A, is the cord of the roofing arch, which measures seven feet five inches. The line B, is the chord of the inverted arch which measures six feet nine inches; and the versed sine of this is nine inches. The line C, is the rise of the side walls between the two arches, and measures four feet. The line D, the radius of the roofing arch, is three feet eight and a half inches. The roofing arch is of brick, eight inches wide, and the sides and inverted arch are of brick, four inches wide. The protection walls are of stone, two feet eight inches in the part parallel with the chord of the inverted arch, and two feet in the part parallel to the chord of the roofing arch, whence the spandrel backing runs off to a point.

In earth tunnels, the entire masonry is brick; the thickness of the inverted arch is eight inches, and that of the sides and roofing arch twelve inches; and in an entirely open cut the conduit has a roofing arch of eight inches thick. In all rock tunnels the conduits are made similar to those above described, except that there is no roofing arch; but the conduit is made water tight above the height of the water line in the earth tunnels. Along the entire line there will be fifteen tunnels, through the rocky hills, varying in length from one hundred and fifty to nine hundred feet. The aqueduct is carried across ravines by means of embankments in which there are capacious culverts to admit the passage of streams of running water, brooks, &c.; there is also a strong foundation wall, built up from the bottom of the ravine to the aqueduct, a little wider than the sectional area of the conduit, and projecting proportionally from the top to the bottom. On the outside of the embankment is a massive protection wall, which is dry laid. Over turnpike roads there are thrown beautiful viaduct bridges, all constructed with the strictest regard to strength and durability. Across water courses, such as creeks and the larger streams, there are thrown beautiful aqueduct bridges, the most imposing one of which can be seen at section 20 (Mr. Young's) in the village of Sing Sing. This bridge is formed of one magnificent stone arch, thrown over the Sing Sing Kill, which has a span of eighty-eight feet, a versed sine of thirty-three feet, and which is eighty feet from the foundation to the crown of the arch. It is believed to be the largest arch of the kind in America. The foundation of the abutments of this arch is solid rock, worked to a perfect surface. The curve of the arch is an ellipsis. The stone at the spring is 4 feet in the bed, and 17 inches thick on the intredos, diminishing to the crown to 3 feet bed, and 15 inches thick. The whole face of the works including the arch, bevels an ½ inch inch to the foot, which makes the ring-stone very difficult to fit. The ring-stone is of granite from the Hudson River Highland; the greater portion of the other stone work is gneiss. This arch, when completed, will have 95 courses, the average weight of each course to be from 10 to 12 tons; 50 courses are already laid, and the calculation is to have the key-stone in by the 26th of next month. The centre used in constructing this arch is on a new principle; it consists of three principal braces so constructed as to radiate from one point at the base of the arch, and terminates in a continuous line at the first and second points of bearing, and at the crown of the arch, and thus sustain all the pressure. On this same section there is also a tunnel 335 feet long, cut through a solid rock, the sides lined with brick, and the rock forming the roofing arch. These are points of the work which, with the great dam, and the viaduct arches across the ravine at Sleepy Hollow (Law's section), and some important points on Mr. Carmichael's sections should be visited by all who can devote a day or two to the pleasing task. A set of bridges will also be constructed on Manhattan Island, that will be highly interesting, from the fact that they will cross eight or ten streets in the upper part of the city.

THE "BRITISH QUEEN" AND "GREAT WESTERN."—MR. HALL'S CONDENSERS.

Sir—You have in your last week's Magazine, with a stroke of the pen so completely answered the remarks of "Observator" respecting the improper blowing out of the boilers of the *British Queen*, showing that it had nothing whatever to do with my condensers, that I shall consider that part of my letter as disposed of, and shall now dismiss him (I hope altogether) after making the following remarks. First, "Observator" will find if he examine my letters, that I have never in any of them detracted from the character of the engines of the *Great Western*, not having even once mentioned them. Second, if he continue to delight to honour them by still comparing them to the broken down racer, I can have no objection; but in speaking of their performances when put in comparison with those of the engines of the *British Queen*, he should not overlook the important point that the latter have to propel one-third more tonnage per horse-power than the former; which to continue

his sporting language, is like the old racer in question, being rode by a jockey of nine stone, the young stout hunter being rode by one of twelve stone.

As you intimate that this controversy ought to draw to a close, and I hope this may be the last letter which I shall have occasion to write. I shall feel obliged by your inserting the enclosed letter from Mr. Lambert, the very intelligent chief engineer of the *Sirius*, during her voyages to and from New York. I trust that you will do this, not only on account of its affording one of the best arguments that I can adduce on closing the controversy, but also from its being a document of much interest to the public. I remain, Sir,

Yours, respectfully,
SAMUEL HALL.

No. 18, King's Arms Yard,
Oct. 7, 1839.

Queen of the East, London,
3rd Oct. 1839.

Dear Sir—I received yours of the 1st Oct. requesting my opinion of the working of your patent condensers, and agreeably to your wish, I beg to hand you the following particulars as the result of my observations while on board the St. George's Steam Packet Co.'s vessels, *Sirius* and *Hercules*, the which I give with the greatest of pleasure. I was in charge of the *Sirius* during a period of eighteen months, in which time she crossed the Atlantic four times, during which voyages I had every opportunity of witnessing the uniform action of your condensers in comparison with those of injection engines, and more especially in the tremendous weather with which we had to contend, the engines always working uniformly without any risk of being choaked by an over supply of injection water as is the case in common engines, and the boilers always maintaining the same level of pure water without the least difficulty or trouble on our part whatever; the vacuum in our mercury-gauge varying 28½ to 29¼ even in the worst of weather; also the working parts of the engines, cylinders, pistons, and piston-rods, valve, faces, and even the air-pumps and rods though not lined with brass or copper, as in common engines, but merely iron, were in beautiful condition. Our distilling apparatus beside keeping up the supply of fresh water in the boilers, kept the crew and passengers to the amount of 90 or 100 with water for washing, and used for various other purposes by the Stewards and Cooks on board; and though our voyages averaged from sixteen to eighteen days, the water in the boilers was always as fresh as when we first started. For the authenticity of the above statement, I can refer you to Mr. William Ramsden, superintendent engineer, St. George's Co's, Liverpool, who was also on board during the said voyage. With reference to the *Hercules*, the nine months' experience I had on board that vessel, plying between London and Cork, and the beautiful action of the engines, condensers and distilling apparatus, fully verify what I have already stated. Since leaving the *Hercules*, I have been appointed to the Hon. East India Co.'s vessel of war, *Queen of the East*, also fitted with your condensers and engines, built by Messrs. J. and S. Seaward and Capel, Canal Iron Works, Limehouse, which far surpasses anything I have ever seen. We have had a trial of the engines at three different times, the vessel being at her moorings, when we got a vacuum of 29⅝ inches of mercury, the engines making 14 revolutions per minute; and I have no doubt when we get out into the river with the engines, making 22 or 23 revolutions, we shall then get a vacuum of 30 inches; but so soon as we have made a trial on the river, I shall be most happy to furnish you with a report of the action of the engines on that day. You have my full permission to make what use you think proper of this letter and to refer any parties to me for further information, either personally or by a letter. Wishing you every success,

I remain, Dear Sir,
Your obedient servant,
JOHN LAMBERT,
Chief Engineer on board the *Queen of the East*.

Samuel Hall, Esq.

P. S. With reference to the above statement, as regards the *Queen of the East*, we, the undersigned, do hereby certify, that we, have seen the engines of the said vessel at work, and do hereby confirm the above statement.

(Signed) WM. BUCHAN, 2nd Engineer.
THOS. WILSON, 3rd Do.

THE "GREAT WESTERN" AND "BRITISH QUEEN."

Sir,—I should not have again intruded my name on your pages, had not "Observator," in your last number, in endeavouring to prove my assertions incorrect respecting the difference in speed between the *Great Western* and *British Queen*, made, himself, one of the most unaccountable and unfounded statements. That I was incorrect in saying that the *Queen* was only two hours behind the *Western*, I allow; but this mistake arose entirely from my not having then, unfortunately, a correct copy of the logs of both vessels. "Observator" says, "any of the journals of the above date (the 15th and

16th of August) will bear witness, to the fact that the *Great Western* arrived early in the morning of the 14th of August, and the *Queen* early in the morning of the 15th." The former part of this statement is correct enough as relates to the *Great Western*, but how "Observator" has fallen into the error of saying the *British Queen* was 24 hours after the *Western*, I cannot conceive.

I will merely quote the *British Queen*'s log to prove the falsity of this assertion. Captain Roberts says, under the date of August the 14th *not* 15th: "One o'clock, P. M., Falmouth pilot-boat alongside; two o'clock, the Lizzard and its lighthouse, in full view; four o'clock, took a Cowes pilot alongside—12 days and 19 hours from pilot to pilot; 13½ days to Portsmouth." And this is what "Observator" calls arriving early in the morning of the 16th. Now I have not altered either the words or date of the log, with the exception of leaving out that part which does not relate to this subject, and the same copy appeared in the journals of the 15th and 16th of August. So much for my "unfounded" assertions and "transparent figments," &c. &c. As to the Americans betting more on the *Queen*'s making the best passage, I am quite content to let "Observator" have it all his own way, but I did not think, Sir, I was altogether justified in overlooking the other charges which has formed the subject-matter of this letter.

I remain, Sir, yours, sincerely,

BOWSPRIT.

London, Oct. 8th, 1839.

SELECTIONS FROM THE PROCEEDINGS OF THE BRITISH ASSOCIATION—NINTH MEETING—AT BIRMINGHAM.

[*Abridgement of Athenæum Report.—**Continued from page 462 of last volume.*]

Sir John Herschel on the non-action of the Red Rays of Light on Photogenic Paper.

[Extract of letter read to the Mathematical and Physical Section.]

Slough, August 28, 1839.

My dear Sir,—May I take the liberty of requesting that you will mention to the physical section of the British Association a very remarkable property of the extreme red rays of the Prismatic Spectrum, which I have been led to notice in the prosecution of my inquiries into the action of the spectrum on paper, rendered sensitive to the chemical rays by Mr. Talbot's process, or by others of my own devising.

The property in question in this: That the extreme red rays, (such I mean, as are insulated from the rest of the spectrum by a dark blue glass coloured by cobalt, and which are not *seen* in the spectrum unless the eye be defended by such a glass from the glare of the other colours,) not only have no tendency to darken the prepared paper, but actually exert a contrary influence, and *preserve* the whiteness of paper on which they are received, when exposed, at the same time, to the action of a dispersed light sufficient of itself to produce a considerable impression. I have long suspected this to be the case, from phenomena observed in taking photographic copies of engravings; but having at length obtained demonstrative evidence of the fact, I think this may not be an improper opportunity to announce it.

When a slip of sensitive paper is exposed *to a highly concentrated spectrum*, a picture *of it is rapidly impressed* on the paper—not merely in *black*, but in *colours*, a fact which I ascertained nearly two months ago, and which observation of mine seems to have been alluded to, (though in terms somewhat equivocal,) by M. Arago, in his account of Daguerre's process. In order to understand what follows, it will be necessary to describe the colours so depicted. The red is tolerably vivid, but is rather of a brick-colour than a pure prismatic red. And what is remarkable, its termination falls materially short of the *visible* termination of the spectrum. The green is of a sombre, metallic hue, the blue still more so, and rapidly passing into blackness. The yellow is deficient. The whole length of the chemical spectrum is not far short of double that of the luminous one, and at its more refrangible end a slight ruddy or pinkish hue begins to appear. The place of the extreme red, however, is marked by no colour, thus justifying, *so far*, the expression which M. Arago is reported to have used in speaking of my experiments—"Le rayon rouge est seul sans action."

It is impossible in this climate to form a brilliant and condensed spectrum without a good deal of dispersed light in its confines; and this light, if the exposure of the paper be prolonged, acts of course, upon every part of its surface. The coloured picture is formed, therefore, on a ground not purely white, but rendered dusky over its whole extent, *with one remarkable exception*,—viz. in that spot where the extreme red rays fall, the whiteness of which is preserved, and becomes gradually more and more strikingly apparent, the longer the exposure and the

greater the consequent general darkening of the paper. * * * *

The above is not the only singular property possessed by the extreme red rays. Their action on paper already discoloured by the other rays is still more curious and extraordinary. When the spectrum is received on paper already discoloured slightly by the violet and blue rays *only*, they produce, not a white, but a red impression, which, however, I am disposed to regard as only the commencement of a process of discolouration, which would be complete if prolonged sufficiently. For I have found that if, instead of using a prism, a strong sunshine is transmitted through a combination of glasses, carefully prepared, so as to transmit absolutely no ray but that definite red at the extreme of refrangibility, a paper previously darkened by exposure under a *green* glass has its colour heightened from a sombre neutral tint to a bright red; and a specimen of paper rendered almost completely black by exposure to daylight, when exposed for some time under the same glass, assumed a rich purple hue, the rationale of which effect I am disposed to believe consists in a very slow and gradual destruction, or stripping off as it were, of layers of colour deposited or generated by the other rays, the action being quicker on the tints produced by the more refrangible rays in proportion to the refrangibilities.

It seems to me evident that a vast field is thus opened to further inquiries. A deoxidizing power has been attributed to the red rays of the spectrum, on the strength of the curious experiments of Wollaston on the discolouration of tincture of guaiacum, which ought to be repeated; but in the sensitive papers, and still more in Daguerre's marvellous ioduretted silver, we have reagents so delicate and manageable, that every thing may be expected from their application.

J. F. W. Herschel.

Mr. Frodsham's Compound Pendulum.—It is an ordinary pendulum, with a steel rod, over which Mr. Frodsham slips a zinc tube, which passes through a brass bob, and rests on the adjusting screw at the lower end of the rod, the bob being fastened at the centre by two connecting rods of steel to the tube, at the point at which the expansion of the tube is the same as that of the rod; so that, as the steel rod expands downwards, and is lengthened by heat, the zinc tube expands upwards in the same degree; and therefore, if the lengths of the rod and the tube be rightly proportioned, the pendulum may be regarded as of invariable length. But, as it is seldom *found that different specimens of the same metal have precisely* the same expansibility, Mr. Frodsham proposes to have several small pieces, or rings of different lengths, cut from the same tube, as correcting pieces, which are to be slipped on or withdrawn, until the length of tube is found that will compensate the pendulum for change of temperature. Mr. Frodsham stated, that the whole in the bob through which the zinc tube passes, is larger than the tube, but there are brass fillets at both ends, with a hole in each exactly fitting the tube; these fillets are perforated with several small holes to admit the air, so that any change of temperature may not be prevented from affecting the part of the tube which is within the bob. The zinc tube is larger than the steel-rod of the pendulum, fillets being also placed at each end of the tube, with a hole in each, just large enough to let the rod pass through. The tube is pierced with small holes throughout its whole length, to allow the air access to the rod. In the suspending part of the pendulum, Mr. Frodsham directed attention to what he called an isochronal piece; it is a brass tube about five inches in length, with a slit about an inch in length at the bottom, to form a spring, so as to slide rather stiffly on the rod. At the upper end of the tube is a clasp, which, by means of two screws, is made to embrace the suspending spring; so that after the pendulum has been adjusted to the length for time, the acting part of the suspending spring may be varied at pleasure, without altering the length of the pendulum, by sliding the isochronal piece up or down the rod, and tightening the screws of the clip. Previously to tightening the screws of the clip, the suspending spring must be allowed to assume its natural and unconstrained position. The rod and the spring being thus united, there can be no wavering motion of the rod, such as is generally found, in a greater or less degree, when the rod and the spring are simply pinned together. Instead of the fork which embraces the pendulum, and connects it with the clock, being a fixture, Mr. Frodsham uses a rod about eighteen inches long, attached to the pallets of the clock, and on this rod is slid a moveable fork, which is fastened by a screw to the rod, at such distance from the axis of the pallets, as is found by experiment to have the greatest power over the pendulum, and thereby cause it to vibrate through the largest arc. Mr. Frodsham stated that by a series of experiments, he had discovered that to any given weight of the bob of a pendulum, some particular length and strength of the suspending spring is better adapted than any other to produce isochronism, and with such spring the pendulum will vibrate through a larger arc with

a given weight, or will vibrate as far with a less weight than with any other, and that, unless the pendulum is first isochronized, anomalies may be imputed to imperfect compensation, which have their origin in a very different source.

Strength of Woods.—Mr. Hodgkinson stated the results of some experiments to ascertain the power of different species of wood to resist a force tending to crush them. The specimens upon which trials have been made were turned into right cylinders, about one inch in diameter, and two inches long. The apparatus used to crush them has been described by Mr. Hodgkinson in an account of his experiments on cast iron, published in the Transactions of the Association. The crushing surfaces were perfectly parallel, and the body to be crushed had its ends bedded firmly against them, the force being applied in the direction of the fibres. The specimens broke by sliding off in a given angle, dependent on the nature of the material, as the writer had found to be the case in cast iron and other bodies, showing that the strength in any particular species of bodies, is directly as the area of the section. Great discrepancies were found when the woods were in different degrees of dryness—wet timber, though felled for a considerable time, bearing, in some instances, less than one-half of what was borne when dry. These experiments were made at the expense of Mr. Wm. Fairbairn. The following were some of the results :—

Description of wood.	Mean force which crushed the specimen.
Yellow Pine	4306 lb.
Cedar	4456
Red Deal	4605
Poplar, not quite dry	2440
" turned and dried	3709
Larch, green	2514
" dry one month	4157
Plum tree, wet, though felled two years	3654
Plum tree, dry	8241
Birch	5953
" dry	5725
Ash	6550
" dry	5725
English oak	4891
" dry	7027
Spanish mahogany	6439
Box tree	7355
" dry one month	7277

Mr. Fairbairn's Experiments on Iron.—The experiments, of which the present is a notice, were commenced by Mr. Fairbairn, in March, 1837, when a number of bars of Coedtalon iron, cast from the same model, five feet long, and one inch square, were placed horizontally on props four feet six inches asunder, and had different weights, as two and a-half, three, three and a-half, and four cwt., laid upon the middle of each; the last weight being within a few pounds of the breaking weight. The intention was to ascertain what effect would arise from each of these weights lying constantly upon the bars. The results are, 1st. The bars are still bearing the loads, and apparently may do so for many years. 2nd. The deflections, which are frequently measured, the temperature being observed at the time, are constantly increasing, though in a decreasing ratio,—a fact, which shows that, though cast iron may be safely loaded far beyond what has hitherto been deemed prudent, still it is extremely probable that the bars are advancing, by however slow degrees, to ultimate destruction.

Mr. Cottam's new Railway Wheel.—The wheels suggested are made on the following principles :—1st. They are wholly of wrought iron, so welded together, that, independent of screws, rivets, or any other kind of fastening, they form one piece with the spokes. 2nd. The spokes of the wheels are placed diagonally, and act as trusses, thereby giving the greatest possible support to the rim, or tire, and, at the same time, being in the best position for resisting lateral pressure. 3rd. Iron in a state of tension or compression, as is usually the case with the tires of the wheels, is easily broken by sudden shocks, or by vibratory action. The wheels in question are so constructed, that the fibres of the iron employed are neither compressed nor stretched, but remain in their natural condition. 4. The strength of iron being as the square of its depth, then the flanged tires of these wheels, which offer sections twice as deep, are, consequently, four times as strong as those of any wheels at present in use. This increase of strength is attributable solely to the peculiarity of their construction, and not to any increase in the weight of the material. 5th. The spokes strike the air edgewise, and thus offer the least possible resistance. Wheels where the spokes present a flat surface may be said to act as blowing machines, and, as such, require a greater propelling power. 6th. These wheels, by simply varying the curve of their spokes, become either rigid or flexible, or, in other words, they may be made to any degree of elasticity. 7th. When worn by friction, the rims or tires may be turned down, and have hoops of railway tire shrunk on them. Thus repaired, these wheels are very strong and durable, and more advantageous than those of other constructions.

Mr. Roberts spoke to the successful use of cast iron wheels, which, properly manufactured, he had never found to fail. The

most important consideration to be attended to was the absence of oxide of iron, and if any was on the metal it must be removed by a file. If this precaution were attended to, there would be little fear for the stability of cast iron wheels.

Mr. Woods stated, that on the Liverpool and Manchester Railway cast iron wheels were much used. They had employed wheels with wooden tires at the opening of that line, some of which were still in use; and so satisfied were the Directors, that it was their intention to have some new wooden wheels made, and to submit them to the test of experiment.

MUNTZ'S YELLOW METAL FOR SHEATHING SHIPS' BOTTOMS.

A few years ago, a patent was obtained for a metal wherewith to cover the bottoms of vessels, and which promised all the advantages of copper, with at least equal durability in any climate, and a considerable saving in cost. It is manufactured in sheets in the same manner as copper, and from its resemblance to yellowish tinted brass, has obtained the name of "yellow metal." Several vessels belonging to this port, and others of London, were plated with it some years ago; but it was found to be less ductile than copper, and therefore less suitable for being laid round angles, or into the grooves or hollows of the stern-post or rudder, where the rudder-irons (or rather coppers) are attached. In some instances, too, when it required renewing, it was found, on taking it off, that it had, to a considerable degree, perished, having become so brittle, and full of minute pores, that, to use the word of a seaman, who examined it, "it broke in the fingers like a piece of gingerbread." This was, however, in the comparative infancy of the invention, and before proper proportions of materials, of which the metal was composed, had been proved by the test of experience; and the friend of science and of commerce will, doubtless, be gratified to learn that such improvements have since been made, as will, in all probability, ere long, render the use of the "yellow metal" almost universal in our mercantile marine, as at once combining economy with durability. The metal is now made sufficiently ductile for sheating; several fine large ships have been bottomed with it within the last few months, and it is so rapidly gaining ground in the estimation of navigators, that we are informed Messrs. Pascoe Grenfell and sons, copper dealers, have, during the last half *year, done much* more business in the article than in copper itself. The captains who have lately given it a trial, speak highly of its good qualities; and one vessel plated with it has made three successive voyages from London to India without requiring any renewal in that particular—showing a durability considerably beyond the copper generally used. The price is 1½d. per lb. cheaper than copper, and it is 6½ per cent. lighter than that metal. It is also found to retain its weight to a greater extent, and the old metal is taken back in exchange by the manufacturers. Another, and perhaps an equally important, use of this metal is, for the bolts or fastenings of ships. From its hardness, when manufactured for this purpose, it is vastly superior to copper, inasmuch as being nearly as hard as iron, it can be driven into a much smaller augur-hole than copper, and to a greater depth in dead wood; forming, consequently, a tighter and stronger fastening, and not so liable to draw, on this account, as well as from the absence of verdegris. From all, indeed, that we can learn, the "yellow metal" may be considered one of the most useful discoveries of modern times in a commercial country like this.

The works are situated within about a mile of the town of Swansea, immediately in the neighbourhood of the copper works, and are at present capable of manufacturing a considerable quantity of sheathing and bolts—there being four pair of rollers, with the machinery necessary for drawing rods, worked by an angine of 54½-inch cylinder, 8½-feet stroke. The metal is a combination of copper and zinc, the best admixture being found to be 60 per cent. of the former, and 40 per cent. of the latter. The metal is delivered on the works, and is then submitted in these proportions to the action of a reverberatory furnace, or melted in pots, from which it is cast in plates or bars, according to the object for which the metal is required, whether "bolts" or "sheathing." It is subsequently submitted to heat, and when, as it appears to us, of a "cherry red," is worked in the cylinders or rollers, or drawn out in rods. The process is in itself exceedingly simple, and affords little novelty to any one accustomed to the manufacture of iron.—*Mining Journal.*

NOTES AND NOTICES.

Gambling by Machinery.—The New Orleans papers give an account of the breaking up of a gambling establishment, the operations of which, it seems, were carried on by machinery. The Bee thus describes the apparatus:—In a back parlor in the second story was a round table fixed in iron shoes so as to be immovable.—Two of the legs of

this table were hollow. Down the hollow legs wires were run to the floor, and along the floor in grooves made for the purpose, to the wall, then up the wall to the third story, thence to a point immediately above the centre of the table. The wires were communicated from the table to the point above, in the manner used in bell hanging. The grooves through which they ran were inlaid with the softest buckskin, so as to prevent a noise in pulling them; the grooves were then covered over with thin copper, and a carpet screened all from view; the grooves in the wall were papered over so as to prevent detection. Immediately above the card table, the ceiling was ornamented with a circular painting, after the fashions of some parlors. In the centre of the painting was a hook as if to suspend a lamp. The ceiling was cut into small holes, which could not be detected from below, because they represented certain portions of the figures of the paintings. When a party was engaged at play, a person above could look down upon the hands and by pulling the wires give his partner at the table any intimation as to the strength of the opposing hands, which an agreed signal might indicate. The room above was kept dark, which also prevented the players from ascertaining the cheat, particularly at night. We hear that such a piece of machinery is erecting in one of our fashionable gambling establishments. Is it so?

Mileage Duty.—A table appended to the Report of the Railway Committee, shows the amount of mileage duty received from railways in England, that have not compounded for the duties. From this table it appears, that the London and Birmingham Company have paid, from July, 1837, to January, 1839, the sum of 10,995*l.* 12*s.* 1*d.*; the aggregate number of miles travelled during that period being 24,111,560.—The Grand Junction, from 4th July, 1837, to January, 1839, 17,032*l.* 19*s.* 10*d.*; number of miles, 32,702,384. The Liverpool and Manchester, from January, 1836, to January, 1839, 21,397*l.* 2*s.* 8½*d.*; number of miles, 41,082,500. The London and South-Western, from May, 1838, to January, 1829, 1,524*l.* 19*s.* 3*d.*; number of miles, 2,927,928: and the Great Western, from 4th June, 1838, to January, 1839, 2,229*l.* 10*s.* 1*d.*; number of miles, 4,280,648.—*Railway Times.*

The Typoface.—The Bordeaux papers mention that a young sculptor of that city has discovered a method of taking casts of the human face, which, without requiring that the features should be reduced to a state of perfect rigidity, allows them to preserve all their natural play, and thus produces an exact resemblance with the animation of life. His name is Pellet, and he designates his apparatus the Typoface.

Aerostation.—M. Garnerin, according to the Paris papers, is constructing a balloon at the Ecole Militaire, which he hopes to direct through the air as he pleases. On each side of the car he has adapted four *palettes*, resembling the wings of a wind-mill, which he puts in motion by the means of a secret internal mechanism. The resistance of the air to every *palette* that strikes it is reflected upon the balloon and carries it forward, just like the flying bird or swimming fish. M. Garnerin, it is added, has already made some experiments which proved perfectly successful.

Street-Sweeping Machine.—A new system of sweeping the streets by means of a machine was tried on Friday at the Barrière des Fourneaux, in presence of a committee appointed by the Municipal Council of Paris. M. Arago was one of the commissioners. The experiment is said to have succeeded.—*Capitole.*

Preserving Beer.—A patent has been taken out in America for preserving beer from becoming acid in hot weather, or between the temperatures of 74 degrees and 94 degrees. To every 174 gallons of liquor the patentee, Mr. Storwell, directs the use of 1 lb., of raisins in the following manner:—"Put the raisins into a linen or cotton bag, and then put the bag containing the raisins into the liquor before fermentation; the liquor may then be let down at 65 degrees or as high as 70 degrees. The bag containing the raisins must remain in the vat until the process of fermentation has so far advanced as to produce a white appearance or scum all over the surface of the liquor, which will probably take place in about 24 hours. The bag containing the raisins must then be taken out, and the liquor left until fermentation ceases. The degree of heat in the place where the working vat is situated should not exceed 66 degrees nor be less than 60 degrees."

"The Atlantic" Steam Ship.—This fine vessel may now be seen, in all her proportions, in the building-yard of the Messrs. Wilson, north side of the Clarence Dock. She is building for the Transatlantic Steam Company, and intended as a companion to the *Liverpool* in the New York trade. Her tonnage exceeds that of the *Liverpool* by nearly 500 tons, and she will be ready for launching in the course of six weeks or two months.—*Liverpool Albion.*

Natural Flowers in Winter.—To produce these, some of the most perfect buds of the flowers it is wished to preserve, such as are latest in blowing and ready to open, must be chosen. Cut them off with a pair of scissors, leaving the stem about three inches long; cover the end immediately with Spanish wax, and when the buds are a little shrunk and wrinkled, wrap them up separately in paper, and place them in a dry box. When it is desired to have the flower to blow, take the buds overnight, cut off the sealed end of the stem, and put the buds into water wherein has been infused a little nitre or salt, and the next day you will have the pleasure of seeing the buds open and expand themselves, and the flowers display their most lively colours, and breathe their agreeable odour around.

New Mode of Marking Linen.—A celebrated German chemist, Mr. Hoenle, has invented a new plan for marking linen without ink. This is effected by simply covering the linen with a fine coating of pounded white sugar. The stamp of iron, very much heated, is impressed on this material. Two seconds suffice for the operation. The linen remains slightly scorched, but the mark is indelible.

Mr. Hancock's Steam Carriage.—In continuation of the account of Mr. Hancock's steam trip to Cambridge described in our last number, we are informed that the *Automaton* made several trips in the neighbourhood of Cambridge, until the carriage was taken almost forcible possession of by a mob who clambered upon it, on all sides, until it contained nearly *forty persons*—Mr. H., unaware of the great load with which he was honoured, on attempting to move his steering apparatus at a turn of the road, had not strength to do so, and although the steam was immediately shut off, the impetus carried the fore part of the *Automaton* into a ditch. Several spokes of the forewheels were broken, the axle bent, and other damage done, but none to the passengers. In a few hours, fresh spokes were put in the wheels, and every thing repaired, and the steamer returned to the inn yard. On the next day Mr. H. ran the carriage to Newmarket and back—each journey of about 13 miles, in a little more an hour. On Friday the *Automaton* returned to London.

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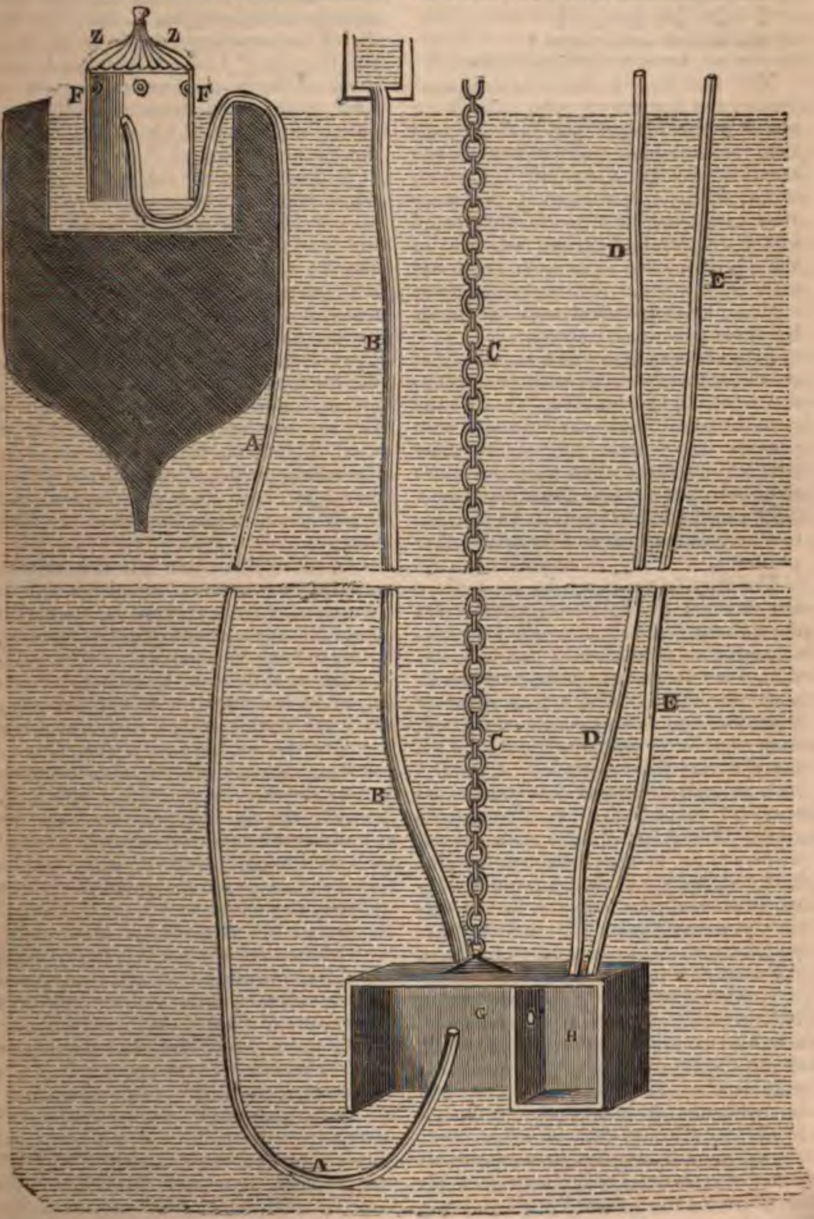
STEELE'S DIVING BELL RECIPROCATING CHAMBER.



STEELE'S DIVING-BELL RECIPROCATING CHAMBER.

"From the groan of the wind-swung oak,
From the sullen echo of the rock,
The ladye knew it well;
It was the Spirit of the Flood that spoke,
And it spoke to the Spirit, &c.
* * * * * *
* * * * * *
The unearthly voices, &c. &c."
Lay of the Last Minstrel, Canto I.

My dear Sir,—I am, as your pages testify, the first person who ever, being above water himself and seeing every thing around him, and holding *communication* with those around him above water, held conversation at the same time with a person who was submerged in the water in the diving bell open at the bottom, from which, in the usual manner, the water was prevented from entering by the condensation of the air by the condensing air pump.

I am also the first who ever, sitting at ease in atmospheric air without condensation, *at* the bottom, ("at," but on the very bottom,) held conversation with persons above water, and at the same time viewed the bottom with the water removed from it, and illuminated by a light which I had brought down with me in a lantern for that and for some other purposes.

The very first person who ever, since the creation of the world, stood upon the bottom of the water—the very bottom—after descending in the bell, and who, while there, held conversation with a person above water, was a diver of Blackwall, on whose steadiness I had, from experience, reliance; and who, upon the occasion I have alluded to, (after I had, of course, myself first proved its security), descended in my "communicating diving bell," and with whom, while sitting in my "air chamber," I held communion of thought, not by signal strokes of the hammer, but by distinctly spoken words: for example, "Are you anxious to be heaved up?" And "No, Sir," the answer.

To that diver, as he stood upon the bottom in his subaqueous pavilion, with a light burning by his side, the piston rod of the condensing air pump was not only as the rod of Moses, which, when he held out his hand and stretched it forth over the Red Sea, laid dry a portion of its bottom; but it was more—it created a passage for the sound of his voice between the ground at the bottom of the water and a chamber above water, which chamber (for experiment) might either float upon the surface, be fixed on the land, or even held in suspension in the air by a balloon.

"The complex idea," (I use these terms in the philosophical sense of that mighty metaphysician, Locke,) of the diving bell, was formerly "a most voiceless thought;" I have endeavoured, with great industry of observation, and by tides of the most patient meditation, to devise means by which it shall be "a most voiceless thought" no longer.

A description of the experiment to which I have alluded, was first published in the *Philosophical Magazine*, under the head of "Account of a Descent in Steele's Communicating Diving Bell," and an article relating to the development of the principle of construction, under the head of "Analysis," forms part of the Appendix to my Essay "on the Improvement of the Shannon Navigation," of which there is a copy in the Library of the London Institution of Civil Engineers, which I presented to the society as one of my contributions as a member, and the work was dedicated to our lamented late President, Mr. Telford.

An entirely new principle of intercommunion by conversation, and not signals or writings, has occurred to me within these few days, in one of those reveries, those dreamy visions, my habitual suboceanic meditations. In order to understand its operation, it is not necessary that the reader should understand the construction of one part of the communicating diving bell, viz., the *communicating chamber* below water; nor is it, indeed, utterly indispensable that he should understand the principle even of the *air chamber*, nor far less that he should comprehend the *rationale* of those labyrinthian mazes, and intervolutions of modes of intercommunion of thought, and of theoretically possible interchange of place, resulting from the principle of construction, in order to have a distinct perception of what I shall describe.

For the understanding this theorem, a perfect knowledge of the principle of the common diving bell will be sufficient.

The French term "*aperception*" is exquisitely felicitous in "the philosophical use of words;" now, although I have a very distinct perception that some things can be achieved by the operation of this principle, a principle depending upon a

property of fluids, which could not be effected by the air chamber, yet still my mind is (as yet) in a state of pure *aperception* of any important *practical* benefit from its application to diving operations *in the present state of subaqueous science*, beyond that which can be derived from my primitive air chamber used for the same purpose.

But, even already, it affords a very interesting *theoretical* improvement, viz., a mode of holding conversation between persons in open-bottomed diving bells at very different depths beneath the surface of the water; and something, as it were, "shimmers through mist" to my understanding, giving a kind of phantasmic prognostication, that by dint of my habit of intensely patient contemplation, and effort at industrious observation of facts in external nature, I may hereafter evolve from my new principle some consequences, not without *practical* utility, either in submarine operations, or if not in these, in some other department of useful knowledge.

The rule of Socrates was an admirable one. Xenophon tells us, in his *Memorabilia*, of the methods which he used to make his friends *more practical*, "πραχτιχω τερουσ." What is a mere theorizer in this age of the world, when the state of human society is in rapip revolution under the magic spell of practical physical science? I don't say he is useless, because every new theorem, however abstract, is so much added to the general stock of human knowledge, but he would be assuredly more useful if "more practical," in the sense in which it was used by Socrates, and by Bacon, the father of the philosophy of induction. That which is done by the agency of solid matter in the case of my air-tight *air chamber*, is, by my present principle of construction, effected by a fluid or fluids, and in a chamber through which a current of air may be in constant flow, and, furthermore, the means of establishing the power of creating interknowledge are generated without the necessity, the *actual necessity*, of the insertion of what I shall designate *the intercommunion voice-pipe*, in any part whatever, either of the subaqueous or superaqueous machinery between which I wish to establish conversational communication. In the air chamber *an insertion is part of the essence of the construction.* I say *for the sake of precision*, "without actual necessity;" but it may also be done by insertion of the tube in solid matter, as in the case of the air chamber.

The reader will permit me to observe, that, by the sectional diagram which I have drawn, I only illustrate *the principle* which has newly suggested itself to me *in its most general form*, and utterly unencumbered at the present by any minuteness of detail.

The diagram represents a transverse section of a ship with a deep tank in it, a section of the *reciprocating diving chamber*, and a rude section of the *communicating diving bell*, submerged beneath the vessel. A, intercommunication voice tube; B, air-hose; C, suspending chain; D, E, communication voice tubes; G, diving bell open chamber; H, separate chamber.

Let a chamber, Z, Z, without a bottom, (just on the principle of the common diving bell,) be firmly fixed in the tank, in the position represented in the section of it in the diagram, its lower rim not touching the bottom. Let there be little windows in it of thick and clear glass, of the same kind as those in the air chamber (not in the diagram) and the communicating chamber beneath the water, which is.

Now, assuming that a flexible tube, the one represented, shall pass from this chamber into the open diving bell before the descent of the latter from the air into the water, and that mercury F F be poured into the tank until it shall rise far above the lower rim of the chamber; it is evident that, by the use of a cock in the chamber, the portion of that chamber above the mercury may be like the diving bell before its immersion, filled with the circumambient atmospheric air without any condensation.

But now, let us suppose this cock to be closed and perfectly air-tight, and that the bell shall then descend progressively into the water in the ordinary manner, it is quite clear that the chamber above water will be progressively filled with air of the same progressively increasing density with the air in the bell in its descent in the water, and that the mercury in that chamber will, consequently, suffer a corresponding progressive depression, the quantity of that depression being determined by the ratio of the difference of the specific gravities of these two fluids; in homely parlance, there will be a sinking of its floor.

I mention mercury, because, in consequence of its great specific gravity, the theorem can have its *practical* demonstration by experiment in so much less room; but water, or *even a fluid lighter than water*, could be used, (for the principle is general), but then, of course, the altitude of the tank, and of the chamber in it, must be supposed to be increased in an inverse proportion; and I, therefore, mention this merely as a pure scientific abstraction in my generalizing.

Supposing the chamber to be graduated, it is evident, *on the same principle of reciprocation*, that the height of the fluid above its bottom would always give the depth of the bell in the water as perfectly as it would be given by the chain of suspension itself, if it were to be graduated for the purpose.

Now the reader will be pleased to observe, that the *voice pipe* A represented in the diagram, plays freely in its undulations through fluids, and through fluids alone; elastic, and non-elastic, air, mercury, and water; but it might have no less than three insertions, viz., in the chamber, and the tank, and in the bell below, or in two of them, or in only one.

As a corollary on this subject, a moment's consideration will show that a hollow cylinder of an indefinite diameter and open at both ends, and (to take the practical *maximum* as yet attained) 29 fathoms long may be placed, being *closely inserted* in the bottom of the tank, in a vertical position, and so utterly submerged, that there shall be a fathom of water above its upper end, and, therefore, that its lower end shall be 30 fathoms under the surface, and yet no water shall enter it, although perfectly open at both ends.

Consequently, and this is what I alluded to at the commencement as an emanation of this construction, a person in a diving bell at one depth under water, may hold conversation with a person in another bell far above, or far beneath him; and even (theoretically speaking) could pass up and down between them in the cylinder open at both ends, supposing its diameter to be sufficient; or, to take what may appear to be a fantastic, but which yet is, perhaps, the most striking fact in illustration which can be *found in nature*, flying fish might soar *from the water below up quite through the cylinder into the reciprocating chamber.*

Assuming that, during the time of this submarine ærostation, the reciprocating chamber were to be immersed and to descend in the water, which is evidently possible, and that the lower end of the cylinder, whether it be vertically or obliquely inserted in the tank, should rest on the bottom; and supposing at that bottom to be the coral named *Madrepora ramea*, the cylinder and the chamber would be perfumed with an odour like that of the hawthorn in full flower in the spring.

"Zephyr with Aurora playing,
As he met her once a Maying,"

is a good illustration of the spirit in which a person plays with a favourite principle in scientific theorizing, in mere theorizing; but there is a mighty difference between mere theorizing, and the putting together of expensive and complicated machinery. "Words are much more easily put together than bricks," said Ariosto.

I have mentioned 30 fathoms as the *maximum* depth as yet attained in diving operations; and it gives me great gratification to be able to announce to the scientific world, that this depth has been attained; a fact, perhaps, more interesting to the physiologist than to the engineer, inasmuch, as it was by sending down a supply of vital air in prodigal superabundance to the divers, lavishly and utterly above the supply necessary to counteract the more mechanical pressure at that depth of the superincumbent water and keep it out of their helmets, that they have lately worked at Navarino, and are now working in the Baltic, at 30 fathoms beneath the surface!

I have been put in possession of this extremely interesting fact in physiology and engineering by the very highest authority. My friend, Mr. Alexander Gordon, of Fludyer-street, in London, Civil Engineer, with whom I have been in communication on my theory of submarine illumination by the oxyhydrogen gas-light, showed me a pistol taken up at Navarino at the depth I have mentioned, by means of that ethereal apparatus to the effects of which I have alluded, and which was prepared and sent out to Navarino under Mr. Gordon's direction.

This letter is intended to be, as far as possible, *practically* useful, in calling the attention of scientific minds to the department of science to which it bears

relation; and I conclude by observing, after my statement of the foregoing most interesting fact, that, as the diving helmet is nothing more or less than a mere small diving bell for the head, it is evident that the principle of intercommunion which I have established either by my primitive air chamber, or by my new *reciprocating* diving bell chamber, is also applicable to this exquisitely beautiful process of performing submarine operations.

This system is to diving bells what railway trains are to stage coaches.

I mentioned this to Mr. Deane, when he was employed in my native county, Clare, and it was on an occasion when I descended in his water-tight dress and helmet, that I had my most interesting observation on solar light, seen through the waters of the Atlantic, and, perhaps, my most interesting meditation on the application of oxyhydrogen gas light for submarine illumination. Fourteen years ago I recommended the use of a guarded lamp let down into the water with a concave reflector.

In this manner do I, by industry in actual observation, and by habits of most patient thinking, make an humble effort that the human voice shall be heard through the waters of the deep, and that they may be penetrated by human vision by (in meditation) conflict between my spirit and "the Spirit of the Flood."

I have the honour to be,
My dear Sir,
With great truth,
Yours, most sincerely,
THOMAS STEELE,
(A.M., Magdalene College, Cambridge; Inventor of the Communicating Diving Bell, and of the Theory of Artificial Submarine Illumination.)

Brussels, 1839.

HEATH'S IMPROVEMENTS IN THE MANUFACTURE OF IRON AND STEEL.

(Patent dated 5th April; Specification inrolled, 5th Oct. 1839.)

Mr. Heath's invention consists, first, in the extraction of pure cast iron from the ore, without the intervention of any earthy, alkaline, or saline matter, to form a vitreous flux, cinder, or slag; second, in producing *cast steel by fusing the pure cast iron so obtained, along with malleable iron or certain metallic* oxides, in such proportions as may decarburate the cast iron to a certain degree; and in carrying the process of decarburation to the farther extent desired, by cementation with metallic oxides, without any admixture of carbonaceous matter; third, in the use of oxide of manganese, without mixture of any other substance, in the process of converting cast into malleable iron, by the process of puddling; and, fourth, in the use of carburet of manganese to make common blistered steel into cast steel.

Malleable iron is at present produced either by smelting the richer iron ores with just as much charcoal or other carbonaceous matter as is adequate to abstract all the oxygen from the ore, and bring the ore into the malleable state; or by smelting the poorer ores, called "iron stones," in contact with carbonaceous matter, in such excess as to form with the metal the compound called carburet of iron by chemists, and cast iron by manufacturers; and then separating the carbon by a distinct and subsequent process. By the first process, malleable iron of very unequal quality in its different parts is produced; and the second process a cast iron is obtained, which is contaminated to a very considerable degree with sulphur, phosphorus, arsenic, silicon, aluminum-calaium, and other foreign substances. A pure native oxide, or carbonate of iron, is alone capable of producing a pure metal convertible into good steel; but such pure ore has been hitherto debased and deteriorated in the smelting, by mixture with earthy, saline, or alkaline matters, under the name of fluxes, added with the intention of promoting the reduction of the metal, and of protecting it when reduced from the oxidizing influence of the blast.

After an extensive course of experiments, Mr. Heath has discovered that such earthy fluxes are not necessary. His operation is commenced by charging the blast furnace successively with coke, charcoal, or other suitable fuel, leaving the tap hole open, that the flame of the fluel, urged by the blast, may play in all directions, so as to bring the whole interior of the furnace into a uniform state of incandescence. When the furnace is thus charged, the tap hole is closed, and 20lbs. of ore are thrown into the furnace for every 100lbs. of fuel. The furnace is charged at this rate

for about 12 hours, when the melted metal is run off into pigs. After this first discharge or casting, the ore is added at the rate of 25lbs. for every 100lbs. of fuel, for a second period of 12 hours, when a second casting of pig iron is run off. After this second discharge, ore is added at the rate of 30lbs. for every 100lbs. of fuel during a third working period of 12 hours, and thus in each successive period of 12 hours, the quantity of ore is increased at the rate of five per cent. of the weight of the fuel, till eventually the proportion of ore amounts to about 65lbs. or 70lbs. for every 100lbs. of fuel. By proceeding in this way, and by throwing in the ore merely reduced to the size of peas, or thereabouts, but not roasted, if the furnace be well attended to by the workmen, it will turn out about 50lbs. of pure pig iron for every 100lbs. of fuel consumed.

To convert the carburet or cast iron thus produced into steel of any degree of hardness, it is melted in a cast iron or cupola furnace, by the heat of coke or other fuel; but, in all cases, no more fuel is used than is requisite to melt the iron, so that the oxygen of the blast shall serve to burn away the carbon of the carburet in a considerable degree, while a further portion of the carbon is neutralized or removed by the addition of scraps of metallic iron, or by the oxides of iron or of manganese.

To produce a superior cast steel from the pure cast iron, sesquioxide of manganese, or peroxide of manganese, which has been previously ignited, is introduced in quantities not exceeding five per cent. into the cupola: no more fuel is used than the blast can readily burn into carbonic acid, otherwise the excess of the carbonaceous flux would deoxidize the manganese, nullify its decarburating action upon the cast iron, and thus prevent it from reducing the metal to that lower stage of carburet which constitutes cast steel. Sometimes, for the same decarburating purpose, a portion, not exceeding five per cent., of chrome ore may be used. When the decarburation has been carried in the cupola to the proper pitch, the steely metal is to be run out, and cast into iron moulds. The ingots thereby formed, are now to be *converted into steel* of any desired degree *of mildness, by a further process of decarburation, which consists in stratifying the said ingots along with peroxide of* iron, or peroxide of manganese, without charcoal, in a steel cementing furnace, which should be lined with sheet iron, if it is constructed of fire bricks or stone, to prevent the action of the peroxides upon the stone or bricks of the furnace. The ingots are to be here subjected to a cementing heat for a certain period, proportional in duration to the softness required in the metal.

Mr. Heath further improves the quality of malleable or bar iron, by adding to the pig or plate iron in the puddling furnace, while in fusion, from one to five per cent., or thereabouts, of any pure oxide of manganese, the sesquioxide being preferred.

An improved quality of cast steel is made, by putting into a crucible bars of common blistered steel, broken as usual into fragments, along with from one to three per cent. of their weight of carburet of manganese, and exposing the crucible to the proper heat for melting the materials, which are, when fluid, to be poured into an ingot mould in the usual manner.

RANKIN'S IMPROVED RAILWAY CARRIAGE WHEEL.

Sir,—I send you herewith, the drawing and description of an improved railway carriage wheel, with the results of a series of experiments I have made with it, which I trust will be interesting to your readers. As it would occupy too much of your valuable Magazine to give a full detail of the experiments I have made, I shall be as brief as possible. The object I had in view was to diminish the friction which the wheels in present use have on curves, and which I consider I have by my improvement accomplished.

Many engineers are of opinion that the cone of the wheel is sufficient to adjust the axletree to a right angle with the rails, and that the flange seldom or ever touches the outer rail of the curve. I grant this hypothesis, if a curve be of the same radius, the engine always travelling at the same velocity, and the carriages of the same weight; but even then they will have a tendency to run in a straight line, for the centrifugal force will cause them to fly to the outer rail, and the flange being on the inner edge of the wheel now in use, will rub against it, and great friction is produced

and much power lost. I have found it so in my small experiments, and I am inclined to think that they are correct, from the fact that *the outer rail is always more worn than the inner.* When trains go off the rails in a curve, in most cases they take the outside; such was the case, for instance, in the accident which occurred shortly after the opening of the Eastern Counties Railway, on that line at Stratford. So different is the action of my wheel on the curves, by the flange being outside of the rail, that if the cone is not sufficient to counteract the centrifugal motion the flange comes in contact with the inner rail, and causes friction sufficient to adjust itself to any curve; thus the friction becomes useful, acting on the same principle as a rudder of a ship.

The experiments I made were with a railway 24 feet long, with several curves on it, and inclined sufficiently to cause the carriages to run of their own accord. The wheels and carriages were all of equal weight and dimensions, and the cones and flanges exactly corresponding, except that the flange of my wheel was on the sinal part of the cone or tyer of the wheel as in the drawing, which position of the flange constitutes my improvement. The action of both plans on a straight line appears to be nearly the same, my wheel gaining but little, but on the curves it gains one foot in eight.

I am, Sir, your very obedient servant,

JOHN RANKIN.

Poplar, July 2, 1839.

A NEW SYSTEM OF LINES, FOR FINDING THE LENGTHS AND BEVELS OF THE TIMBERS IN A HIP-ROOF.

Sir,—Having been rewarded by the Society of Arts with the Silver Isis Medal, for a system of geometrical lines, invented by me, for obtaining the length and bevels of the timbers in a hip-roof, I hope to be allowed, through the medium of your invaluable journal to communicate it to the public, hoping it may be the means of creating a discussion of the theory of roofing lines in general. I am not aware that any thing relating to this subject has been brought before the public since Nicholson published his Carpenter's Guide. The method I here introduce will be found to be on entirely different principles to the one in the Guide; how far it merits a claim of superiority is left for the public to determine.

I am, Sir, yours respectfully,

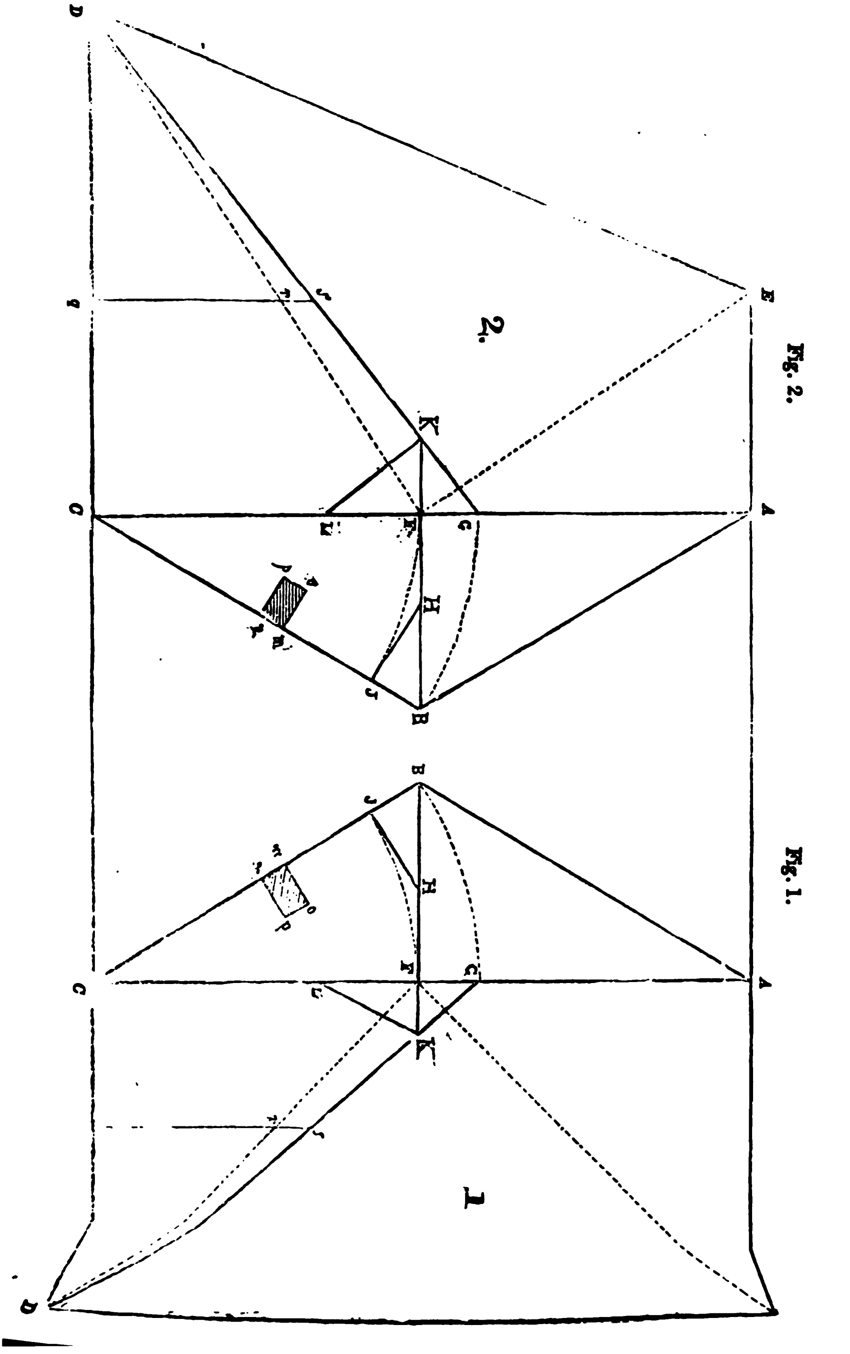
JOSHUA JEAYS.

Leicester, September 2, 1839.

Let A E D C, in fig. 1, represent the wall plates of a building; A B C, a vertical and transverse section of the roof, A B and B C representing common rafters; the dotted lines E F, D F, the seats of the hips, and the line *q r* the seat of a jack rafter; let also B K represent a line from the ridge-piece at right angles with A C, and *m n o p* a section of the punlin placed in its proper position with respect to the common rafter.

Then, with C as a centre and radius G B, cross the line A C in G, and with the same centre, and radius C F, cross the line C B in J, join the points D and G, and from the point J draw the line J H perpendicular to C B, meeting B K in H; set off the distance J H along the line A C from F to L, join the points K and L and produce the line q r to s: this being done the lengths and bevels are as follow

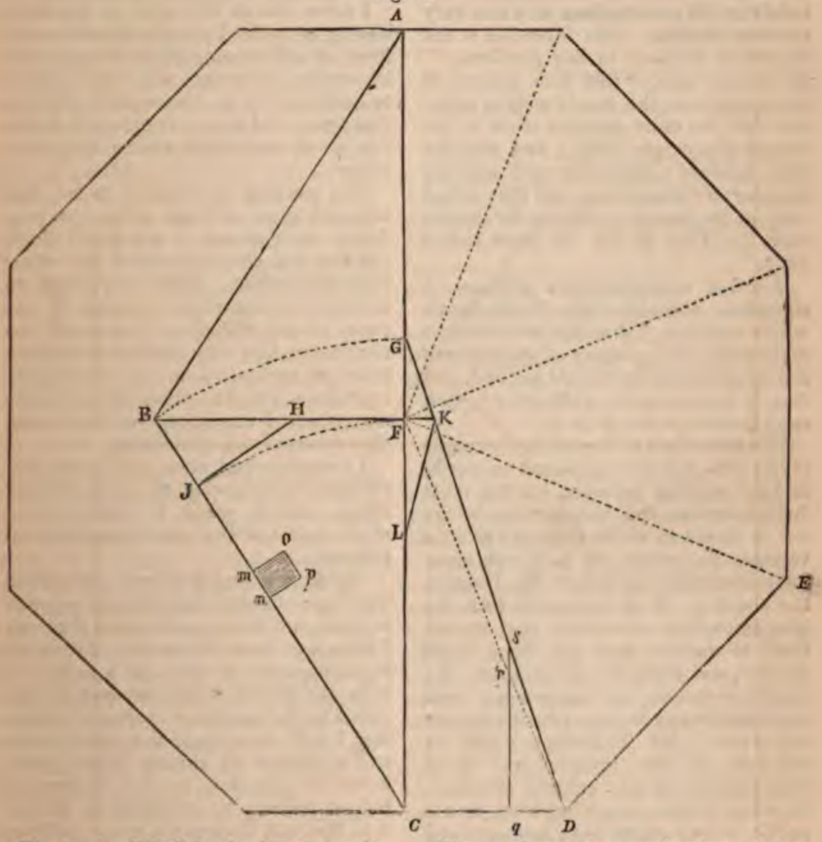
Lengths of Timbers.—A B or B C is the length of the common rafters; *q s* is the length of the jack rafter whose seat is *q r*; and the line D G is the length of the hip rafter.



Bevels of Timbers.—The angle C B F is the bevel of the head, and the angle B C F, that of the foot of the common rafter.

The angle D G C is the bevel of the top or bottom side of that end of the jack-rafter that buts against the hip, and C B F is that of the vertical sides of the same.

Fig. 3.



The angle C D G is the bevel for the side of the purline that is marked *m n*, and the angle B K L is the bevel to be marked on the side *m o* of the purline, and if the purline be cut to these bevels it will be found to fit against the hip.

Fig. 2 shows the application of the above method to a building with an oblique end, and fig. 3 shows its application to an octagonal building, the figures being marked alike, the same letters of reference serve for each.

MAKING SUGAR BY STEAM AND IN VACUO.

Sir,—In No. 468 of your Magazine for the year 1832, I find a letter on the above subject, by a Mr. Booth; he says, "the process is likely to revive the spoiled fortunes of the West India *planters; that they are indebted for it to the indefatigable exertions of* Mr. *W. Oaks, of Houndsditch,* and that jus at the period the new apparatus for crystalizing the cane juice, reached Demerara, the Board of Commerce was discussing the propriety of giving 10,000*l.* to some French adventurers, for divulging a process, thought to be similar." He does not, however, affirm that Mr. Oaks is the actual inventor.

An article on the same subject, written by a Mr. T. Dodson, of Demerara, and inserted in the *Demerara Gazette*, follows Mr. Booth's communication, and that gentleman observes, "It is the first of many scientific experiments and much indefatigable perseverance of a late very eminent chemist. The invention is not absolutely ascribed to this gentleman." He further adds, "that four gallons of sugar made in the *teache* weighs 24lb., but that the same quantity made in the *vacuum pan* weighs 32lbs., and that the Hon. Edward Charles Howard was the inventor of the said pan, and that it had been in use amongst refiners for twenty years." That is, for 20 years before 1832.

Another communication without a signature, succeeds Mr. T. Dodson's which remarks, "that the *new* method makes *twice* the quantity of sugar which can be produced by the *old* method, and that it fetches *twelve shillings per cwt. more in price* in the market.

Here then is one of the most unfortunate inventions that ever appeared on earth, and not only *not patented*, but the West India planters and the community are left in doubt to whom they owe this invaluable obligation, for it is not absolutely conferred on either Mr. Oaks or the chemist. If it originated with the gentlemen here mentioned, they are entitled to receive from the West India planters and from the government, the largest premium that has ever yet been conferred for any discovery during the last 200 years! Mr. T. Dodson ought, at any rate, to have favoured the world with the *name* of the "eminent chemist," to whom it is so much indebted, that a public tribute might have immortalized his memory.

I will now, Sir, proceed to give you a short and a very faithful *history of this invention*, but without the smallest desire to withdraw a particle of merit from any one who may have been actively engaged in carrying it into effect; for even supposing that the vacuum pan had been in use for twenty years amongst refiners, it had never been employed in crystalising the juice of cane until a period subsequent to that, nor did the *actual inventor of the new method of making sugar, know that such a machine existed at the period of his experiments.*

In 1822, ten years previously to the date of these letters, I was resident in Bahia. The Brazilians were then fighting for their independence. The above city was the last the Portuguese held, and it was many months besieged before they capitulated. During that time all commercial pursuits were suspended.

I never was an idle man, so that after leaving my office I usually passed two or three of my evening hours in my small laboratory, analysing and synthesising, or distilling for my amusement. During this protracted leisure therefore, I found this a very acceptable source of gratification.

One morning it occurred to me, that although sugar and salt are articles produced from almost a colourless fluid, yet the one was *brown* and the other *exquisitely white*. After frequently reflecting on what could possibly be the cause of *this difference*, I came to the conclusion that the saccharine particles must be *carbonised* in the operation of crystalising the cane juice, which was the only reason I could form for their being thus *browned and discoloured*.

I therefore had some apparatus constructed to evaporate the said juice by *steam, and in vacuo* in order that I might boil it at the lowest possible temperature.

My first experiment was successful. The sugar formed into crystals as clear as glass, but were much larger than any I have seen from Demerara. I resolved in consequence to take out a patent for it in the Brazils, wrote my own *specification* in Portuguese,—(a copy of which, Sir, I will show you, the ink by time and a change of climate being much faded)—I placed it in the hands of a judical friend who promised to convey it to Rio, and to secure it every requisite attention. The government, however, was at that time so unsettled, that I heard nothing more about it up to my departure for England in 1825, and nothing since, although I have written from time to time for information.*

Before I quitted that country, however, I very thoughtlessly admitted a *Frenchman* into the secret, as my family are fully aware, to whom I promised half the benefits resulting from the patent, on condition that he would undertake its entire management. This gentleman shortly after disappeared, and

* We have inspected the specification referred to. It is dated "Bahia, 25 Junho 1822"—and there can be no doubt of its perfect genuineness.—Ed. M. M.

in the course of time I observed a paragraph in the *Morning Chronicle*, "that a patent was taken out for the invention in England." I therefore concluded I had been betrayed—that the advantage was lost to me, and there the matter rested.

About 1833 I was shown some samples of the sugar from Demerara, by a broker who informed me that it was held in bond, as government conceiving it to be half refined, would not admit it for home consumption. I then wrote to Lord Althorp on the subject, told him he had been misled, showed him that the crystals were perfect, that it needed little refining, that the sugar was made as nature makes her salt in bays, without *burning* it; that all sugar had, by *carbonisation*, been the *opposite* of what it *ought* to have been, and that it was his duty to encourage and protect so important an improvement, instead of ruining the parties who had introduced it, by such an inequitable prohibition. This correspondence, I believe it will be found, was the cause of relieving the crystalised Demerara sugar, as it is termed, from bond, and of securing that benefit to the planters who had produced it, which his lordship's erroneous impressions had previously deprived them of.

As the above facts are capable of the most indubitable proof, no one can equitably dispute with me the merit of planning and applying the apparatus to the crystalising the juice of cane, nor of obtaining for the Demerara sugar the privilege of home consumption; although up to the present I have benefited by neither, and possibly never may.

Indeed I not only used the apparatus for the above purpose, but for making a most perfect and beautiful extract of Brazil wood, which I at one time intended to have effected on so large a scale locally, as to have saved all the freight on shipping it home in bulk.

Now, is it not incomprehensible, that here is a process which enables the West India planter to make double the ordinary quantity of sugar he has been accustomed to make; which sells for twelve shillings a hundred weight higher than the usual quality of brown, raw sugar; that it has been in active operation locally—and of course universally known—*for at least seven years*; that *he complains of the indolence of the* now independent negroes, while this process would remedy the inconvenience and make up the deficiency; and yet the said process appears still to be confined to a few planters in Demerara, where it was first carried into effect?

Yours respectfully,

W. A. Kentish.

STEAM CARRIAGES ON COMMON ROADS.

Sir,—It is, I believe, years back since I published in your pages my declaration of faith in the eligibility of steam carriages for highways to take the place of horse power. Notwithstanding the blunders innumerable which have been committed by steam carriage projectors—notwithstanding the almost marvellous rapidity of railroad progression—notwithstanding the entire public apathy on the subject, my faith is still unchanged. Perhaps, some of your readers may think it would be well to use it to remove a portion of the hills from the highways, but unless they have thought as earnestly as I have on the subject, their disbelief will make nothing to the argument. I believe that, at this time, Mr. Hancock's engine is far superior to any in use on the railroads, and that if the railroad engines were tried by the same test his has been exposed to—roads of rough metal—those same roads would "gar them a' in flinders flie," in less than twelve hours' trial. At present, on the smooth iron rails, they double their original cost within twelve months in the form of repairs, and it is not very creditable to the skill of our engineers that such should be the result, after the ample experience of ten years.

But superior as Mr. Hancock's engine unquestionably is, neither his nor any other is as yet fitted for road work. It possesses the element of power, but it does not possess the element of durability. To enable him to work to profit, it must possess the average durability of a common stage coach, at the least; but it ought to possess much more. Mr. Hancock has made an excellent engine, but he has not made an efficient steam carriage. But he is not the man to despair, nor has he any reason. He is not fighting to accomplish an impracticability. All the elements exist to make a durable steam carriage, but they are at

present in an uncombined state. When these elements shall be efficiently combined, all the world will say, "How simple! Why was this not thought of before?" And then the mass of persons existing by, and for, the highways, will rush in crowds to embark in the new project, with a credulity as absurd as their present incredulity. They will speculate on inflicting the same mischief on the railroad companies, that the railroad companies have, as they fancy, inflicted on them, though they have suffered more by their own want of energy than by anything else. The railroads have, to a great extent, created their own traffic, and efficient vehicles on the highways will do the same.

Let me not be misunderstood. There can be no rivalry between railroads and highways; each have their appointed purpose to fulfil. *Cæteris paribus* the railroad will carry both cheaper and faster, but there are abundant circumstances peculiar to highways which will compensate for the slower speed and extra cost whenever the highway-*men* shall recover from their paralysis. The railroads will benefit still more than the highways by the success of steam on the highways; for the steam carriage, which on the highways attains an average durability, will on the railroads be absolutely indestructible.

When the Liverpool and Manchester railroad was about to come into use, the directors offered a reward for the best locomotive produced. The result was the present railroad locomotive, in which no further improvement has been made.

Let the trustees, and others connected with highways, become a body, and offer a premium for the best plan of steam carriage, and they may depend upon it that, out of much rubbish, they will find some few effective. If not sufficient, give a second premium for improvements on the first plan, and out of many brains the thing will grow perfect, and the stigma of apathy be removed from them. Let the joint body then build the trial carriage at their own expense, and not leave it to the imperfect means of projectors, who, being reduced to expedients, are apt, in sailor phrase—"to spoil the ship for a hap'orth of tar." *The best plan* being obtained, the best *workmen and materials should be provided to carry it out.* There is no fear of the result, when once the scheme takes the business form it ought long since to have taken, and without which, exemplified in the conduct of the projectors of the Liverpool and Manchester, railroads would still have been a theory as regards public travelling. Let the highway-*men* give up the temporary feverish excitements of newspaper paragraphs, respecting the doings of Sir James Anderson and others, and put their own energies to their right uses, and it requires but little foresight to predict their complete success. Let them continue with their hands in their pockets, waiting for an Act of Parliament, or the chapter of accidents, and they may wear away their whole existence in fruitless repining.

I remain, Sir,

Yours very truly,

JUNIUS REDIVIVUS.

October 15, 1839.

BRITISH AND FRENCH ENCOURAGEMENT OF INVENTION.

"They manage these things better in France," is an old saying; but, perhaps, it was never more strikingly exemplified than by the opposite courses pursued by the governments of Britain and France, in respect to two great desiderata in art.

The British ministry are in want of some easy method of carrying out the penny postage plan (conceded only to the unanimous demand of the people), and many hundred thousands of pounds are dependent on the suitableness of the plan which may be adopted. Well, *to make sure* of having the *best plan* which human ingenuity can possibly devise, the British Ministers offer a reward of ——200*l.*! Nay, more; they liberally throw open the competition for this magnificent prize to the sons of genius of all nations! The lively and dexterous Frenchman, the dreamy German, the methodical Prussian, the inventive Swiss, the slavishly imitative Russ, the dull Belgian, the duller Dutchman, nay, even the stolid Turk, who never invented any thing in his life, save, perhaps, the bowstring and sack, have been all alike invoked to come to the aid of the *unmechanical* and *torpid* genius of Great Britain, and are all expected to be stirred to un-

wonted emulation by so glittering a prize!

Now for the contrast. The government of France are in anxious search of a preventive of forgery; and, that they may not fail to obtain it from want of sufficient encouragement to their men of science to apply their minds to the subject, they offer a reward of more than seven times 200*l.* "A premium of 36,000 francs, (1,500*l.*)," says our contemporary *Galignani*, "has been proposed by government, for the discovery of means to prevent forgery of stamps. water-marks in paper, and engine-turned engraving, and also for an indelible ink, so that characters once written with it on any writing material cannot be obliterated. The decision is to be under the direction of the Academie des Sciences, which has long been consulted by government on the means of saving the public and individuals from frauds of this kind. We are informed, that, in order to show how easy it is to get over every precaution that has hitherto been taken to prevent counterfeits, imitations of every species of invention for that purpose have been exhibited to the officers of the different government departments, which were so perfect that it was impossible to distinguish them from the originals. The trial was not extended to the notes of the Bank, because that establishment protested against its being made. It is said that the loss sustained by the revenue from documents written upon stamped paper being, when no longer of use, obliterated by chymical process, and the stamps used for fresh purposes, amounts to 600,000 francs a-year." The difference, it must be confessed, is considerable between 200*l.* and 1,500*l.*; nor is the larger prize likely to be the less tempting, that the competition for it is confined (as we understand) to France. The French Ministers think they may safely rely on the native talent of their country; and, we hope, will find their reliance not misplaced. At all events, it must be allowed that they have given their native talent noble encouragement. A couple of years would not be mispent in earning a prize of 1,500*l.* But 200*l.*! Either for native or foreigner, and whether money or time is considered, it is a miserable—to the British ministry—*most disgraceful pittance.*.

S.

ANCIENT INVENTIONS.

Sir,—If the following extracts from an old German work, appear to you likely to interest the readers of the *Mechanics' Magazine*, may I request their insertion. The work has the following title; "Deliciæ Physico-Mathematicæ," by Daniel Schwenter, Professor of Mathematics and Oriental Languages in the University of Altdorff; Nuremberg, 1636.

In one of the extracts you will recognise the principle of Rangeley's *modern, patent* roller pump, (see *Mech. Mag.*, vol. 1, p. 202). In another, the *lately* invented swimming belt, and a *modern* recipe for waterproofing. Truly, there seems to be "nothing new under the sun." Many of the articles in this curious *old* book, as stated in its preface, are taken from *still older* works. Some of these, at a future time, I may send to you.

The old wood cuts I have copied as accurately as possible upon tracing paper, for the use of your engraver.

Believe me,

Respectfully yours,

N. S. HEINEKEN.

Sidmouth, Devon, Sept. 13, 1839.

To construct a Fountain Pump.—"In an oval box, C D, fig. 1, are fixed two cogged wheels, A B, of such a form that when the wheel A is turned, the teeth of the one shall lock closely into those of the other, and that the teeth of both wheels shall fit close to the

Fig. 1.

interior of the oval box. On one of the wheels a handle must be fixed, which may be turned outside the oval box. If the handle be on A, the wheel A will be made to turn round in one direction, and will drive B round in the contrary direction, and by these opposing movements the air and water will be carried up by the hollows of the wheels. As the wheels are thus continually

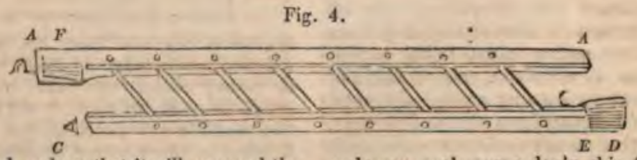
turned, the water mounts and finds no egress but through the pipe, F."—Extracted by Schwenter from a French author.

How to prepare an Air or Swimming Girdle.—Fig. 2. "From Frauz Mössler.—Take a piece of leather and cut it half an ell

Fig. 2.

Fig. 3.

Fig. 4.



broad, and so long that it will go round the *body, and then furnish it with two straps. Now separate the leather into two parts,* and upon each sew a dog's skin (prepared in wax and turpentine in the manner after described) and in such a manner that the

dog's skins shall be sewn, as it were, near one another, like two sacks. After that, you must furnish each of these bags of the swimming girdle with a wooden pipe, so long, that when the girdle is fastened round the body it may reach to the mouth, and both pipes must be well sewn to the bag and strongly bound round, so that one may perfectly trust to them. Then, lastly, each pipe must be provided with a stopper, which shall hang on the end of it, and fit tight into it. And in order that the girdle may be more easily blown up and better hold the air, you may cause a piece of bladder to be fastened under the pipes. How such a girdle is to be supplied with rings and straps you may best see from the figure. Such a girdle is a good thing to take with you on ship-board, since it is easily blown up and may be used for a cushion; and you may save yourself with it, since it will not let a man sink."

Recipe, for preparing the leather, "take 2 lbs. of wax, 1 lb. of Venice turpentine and ¼ lb. of pitch, and melt together."

How to make a pair of Wind Breeches, with which you may walk over the sea or any still standing water.—"Make a pair of water boots of ox hide, prepared in such manner as we have before spoken of, reaching nearly to the navel, and which may be fastened on the body in the way that the breeches of the Swabian peasants are fastened. He, however, who can stand the water does not need these things. Then you place about your hips two bags of dog's skin made in the above described manner, and provide them with pipes and valves and stoppers, as in the case of the swimming girdle. Further, you must cause a pair of leaden soles to be made according to the person's weight, in order that the head may remain erect, and bind them on fast with leathern straps; above these you bind on your feet two fins, so to speak, as may be seen from the annexed figure (fig. 3). Bind them above the ancles, and use them for rowing, to enable you to go wherever you will—and for this purpose you must have on the foot a contrivance to render them moveable. With such a pair of wind breeches, his royal Majesty of Denmark is said to have walked about a long time, with a court servant, on the open sea."

How to make a Ladder, so that you cannot see the rundles, and which is in form like a pole. — "Cause two ladder trees A D B C (fig. 4.) to be made, which are in the middle hollow; and above, at B and D have a projecting piece B F and D E. Then in the hollows you fasten good strong broad rundles of oak or other strong wood, with strong wooden, or what is better, iron rails on which they may be moved up and down; so that when you push the two ladder trees together, the rundles withdraw themselves into the hollows; and when it is thus shut up, it appears like a pole, and not a ladder."

ON PROVISIONS AGAINST FIRE—VOLUNTARY FIRE-BRIGADES—FIRE-ESCAPE LADDERS, &c. &c.

Sir,—From the truly apathetic indifference, which too commonly prevails with regard to fire-prevention and extinction, it is extremely gratifying occasionally to observe exceptions to the general rule. We are all of us much too apt to think, that the providing of any safeguard against the disastrous consequences of fire, is a matter so wholly unimportant as regards each of us, individually, as to be not worth the outlay of a single shilling—nor even worth a thought; constantly illustrating to the very letter, the truism that "what is every-body's business, is nobody's."

The fact is, that there is no calamity of life, to which we are, every one of us so liable, as that of *fire;* and this too, in spite of our utmost vigilance and care: for we are each exposed to all the consequences of our neighbour's recklessness, as well as to a numerous class of accidents, scarcely to be guarded against.

A feeling of indifference to these matters manifests itself most strikingly, when observed collectively, as in *parishes*, where the neglect of all precautionary measures, and the entire withholding of encouragement for laudable exertions, has long been notorious. Without entering into needless detail, I would just observe, by way of illustration, that there are at this time many populous parishes in this metropolis, in which scarcely a *mark* is to be found affixed to the houses to indicate the situation of the *water-plugs;* although every churchwarden or overseer is liable to a penalty of *ten pounds* for neglect of this highly important precaution,* one moiety of which goes to the informer. I fancy some of those useful nuisances, ycleped "common informers" might reap a fine harvest by taking up this matter, and while enriching themselves would really do a great public service.

As I said before, however, it is pleasing to find a different feeling prevail. I have already alluded in your pages to the voluntary fire-brigades of Southampton and Cheltenham, and I am happy to state that both are highly prosperous: the latter is now composed of twenty-four men fully equipped after the manner of the London Fire Establishment. The parish of St. Clement

* By 14th George 3d, cap. 78.

Danes, imitating the example of several others, have had the good sense very recently to adopt Merryweather's portable fire-escape ladders, which had only been stationed in the parish a few weeks when they were the blessed instruments, under divine Providence, of saving the lives of nearly a dozen individuals at a fire in the Strand on the 3d instant. One of the persons thus rescued, has addressed a letter to the Editor of the *Morning Advertiser*, expressing his gratitude for the promptitude and skill with which assistance was afforded, as well as his admiration of these ladders, which he acknowledges to be the very best means of guarding against the fatal calamities too often attending metropolitan fires.

Attention to this subject on the part of London parishes, is more needful than ever, since the failure and breaking up of that precious piece of *humbug*—the "Fire-escape Society."

Many of our nobility have shown a laudable anxiety to counteract the destructive influence of fire, by suitable provisions for its suppression. The Dukes of Devonshire, Northumberland, Rutland, and Sutherland, Sir Robert Peel, with many other noble peers and wealthy commoners, have very respectable provisions for dealing with accidental or wilful conflagrations. But his grace, the duke of Buckingham, has surpassed all his compeers, in the extent and completeness of his fire-establishment at his magnificent seat, Stowe House, Bucks. His grace has already eight fire-engines; four of them are small portable engines, similar to those now so extensively adopted on board steam-boats, and shipping generally, a description of which may be found in your 645th number (page 226, vol. xxiv). These are stationed on different floors within the building, while four of a larger description are judiciously placed around the mansion. There are four elevated reservoirs of water within the building, furnished with connecting screws and leather hose, for direct application, or for supplying the portable engines. In addition to the above, Mr. Merryweather is now building for his grace a powerful carriage engine, with seven-inch barrels, precisely similar to those supplied by him to the London Fire Establishment, and furnished in the same complete manner. Twenty-four picked men from his Grace's domestics form his fire-brigade, six of them being armed and accoutred, in the London fashion, with axes and helmets. The whole is under the direction of an active and intelligent engineer from London. Due precaution has been taken to provide an abundant supply of water, and Mr. Merryweather is building a travelling *hose-reel*, which will afford the means of rendering the most remote piece of water in the grounds, available in case of fire, in a very few minutes. So far as the protection of this splendid mansion is concerned, every thing is upon the most secure footing, though it is most devoutly to be wished that the provision thus made may never be required. The inhabitants of the country round for miles, will however participate according to their necessity, in the benefits of his Grace's protective measures, which, among other advantages, will be likely to counteract to a very considerable extent, the diabolical practice of incendiarism, which seems again to be on the increase in some of the agricultural districts.

To those who have the means of imitating the noble example of his grace of Buckingham, or indeed to *every person to the extent of their ability*, I would most earnestly say—

"Go thou and do likewise."

I am, dear Sir,

Yours very respectfully,

WM. BADDELEY.

London, October 9, 1839.

Errata, in my last communication, page 20, col. 2, to line, "for two and three *months*"—read "two and three years."

NOTES AND NOTICES.

Photogenic Engraving.—The means have just been found of engraving the Daguerreotype drawings, and of engraving them on the spot. This very important discovery is due to Dr. Donné, who has had the felicitous idea of applying the ordinary process of engraving directly to the proofs taken with the Daguerreotype. However extraordinary this result looks at first sight, it is not the less certain and authentic. We have examined the first plates obtained by that able observer. They have been submitted to the Academy of Sciences, where they have caused a very great sensation. Dr. Donné's discovery appears to us almost as important as that of the Daguerreotype itself. When he shall have brought to perfection his engraving process, then only will the Daguerre apparatus prove to the traveller, antiquary, and naturalist, the most valuable resource. When the image of the most complex monument or most minute preparation of natural history shall have been finished, every traveller or observer, by immediately engraving the plate, will be able to compose himself the picturesque part of his work, and to multiply its proofs at a cheap rate. The primitive art which obliged us to make collections of unique pictures upon silver plates, is therefore about to take a far wider range. It will quit the cabinets of the curious, and enter the domain of the graphic arts in general and of popular education.—*Paris paper.*

Errata in the Review of Mr. Kentish's Treatise on a Case of Instruments. Page 22, line 7, for "plum rule," read "plain rule;" l. 20, after "are," insert "not." P. 2, l. 14, for "the little," read "this little;" l. 20, after "recommend," insert "it."

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 846.] SATURDAY, OCTOBER 26, 1839. [Price 3*d.*

Printed and Published for the Proprietor, by W. A. Robertson, No. 166, Fleet-street.

WING'S ROTARY HYDRAULIC ENGINE.

Fig. 1.

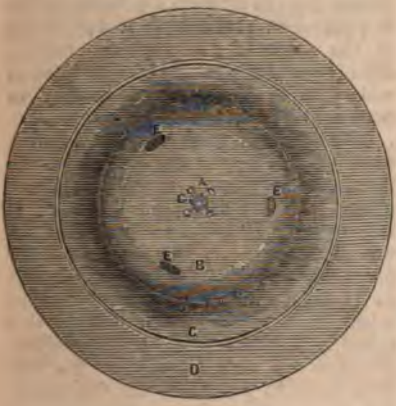


Fig. 2.

4.

5.

3.

WING'S ROTATORY HYDRAULIC ENGINE.

Sir,—When I was in the United States, in 1836, I went to Troy, up the Hudson River; near this city there is a dam across that river, the water from which drove some mill and machine-shop wheels. Amongst the wheels was Wing's patent re-acting wa'er-wheel; this wheel is on the principle of Barker's mill, but by far the best modification I have yet seen of that machine. It works horizontally, with a head of water over it of any height, so long as there is the slightest fall from it; the over and under-shot wheels being frozen up so many months of each year, first led to the invention. The following sketch will give some idea of its construction:—

The same letters refer to similar parts in the different figures.

Fig. 1 is a plan of the horizontal-wheel; A, axle; B, water-way to the segments, and the bottom plate; C, funnel or entrance for the water; D, cover over the segments, cast in one piece with them.

Fig. 2. A, axle; B, water-way and bottom-plate; D, segments with the cover taken off, and the funnel removed. The arrow denotes the direction the wheel revolves in.

Fig. 3. Side view. A, axle; C, funnel; D, segment mouths, or the exits for the water.

Fig. 4. The bottom-plate; it is bolted on to the other part of the wheel by the bolts F; G, open socket for the axle, which is fixed to the wheel by the screws seen in the socket; E, openings to prevent the pressure of the water upwards from being too great.

Fig. 5, is a section of the bottom-plate, which is convex upwards.

The wheel is five feet in diameter, made of cast iron, cast in three pieces, viz., the segments, the funnel, and the bottom-plate; it is walled in, and no water allowed to pass, but what enters the funnel and rushes out at the segment mouths.

The sketches are not drawn to a scale.

Yours faithfully,

ARTHUR TREVELYAN.

Wallington, Oct. 9, 1839.

DESTRUCTIVE COMBINATION OF IRON AND LEAD.

Sir,—It has often appeared to me extraordinary that in this scientific age, the use of one of the strangest errors in the combination of metals should still be persevered in, which must anciently have originated in ignorance of the effects, and seems to continue up to the present unnoticed.

Every one is aware, that when two metals come in contact, a *galvanic action* is produced; particularly if any thing in the shape of a *sub acid* intervenes. This is peculiarly exemplified in pewter, which gives considerable vivacity to porter, that is *flattened by glass*.

This action is strong or weak, and is more or less destructive to one of the metals, in proportion to the affinity for oxigen which is thus brought on it. If we are anxious to insure the preservation of all the metals that must, in many operations, be brought in contact with each other, we should take care to select such whose union creates this chemical influence *as little as possible;* although the very reverse of this has been hitherto practised, and has occasioned an unlimited expenditure, nine-tenths of which might have been avoided.

There is not a square, and scarcely a house that is not surrounded with iron railings, and these are pretty universally fastened in at the lower extremity, by *lead.* This combination of *iron and lead* keeps up so strong a *galvanic* action through the medium of the oxigen of the air, that the rails are, in a very moderate time, eaten away at the junction of the two metals, which must yearly entail an enormous loss that might easily be prevented.

The *iron*, in this instance, becomes the *protecting* metal, and thus *preserves the lead from decomposition*, which never could have been originally contemplated.

Now, if instead of using the lead, which is thus thoughtlessly rendered an inveterate enemy to the rails, we were to substitute *zinc*, for instance, this galvanic influence would then become *inverted*, the whole of its action would fall on the *zinc*, and the iron would be *preserved*, and as the zinc is oxidated with difficulty, it would, at the same time, be scarcely acted on; the one remaining uninjured, and the other nearly so.

Paint, formed of the *oxide of zinc*, for the same reason, would preserve iron exposed to the atmosphere, infinitely better than the ordinary paint which is composed of the *oxide of lead*. In some instances of late years, iron covings have been used instead of stone. The rails are inserted in a square hole that just fits the bars, the unsightly method of filling up with lead is avoided, and all parts of the iron expand or contract equally in heat and cold. Whereas, with stone, the humidity in winter insinuates itself into the cavities round the fittings, and as it fuzes and so increases in volume, it bursts the stone covings in all directions.

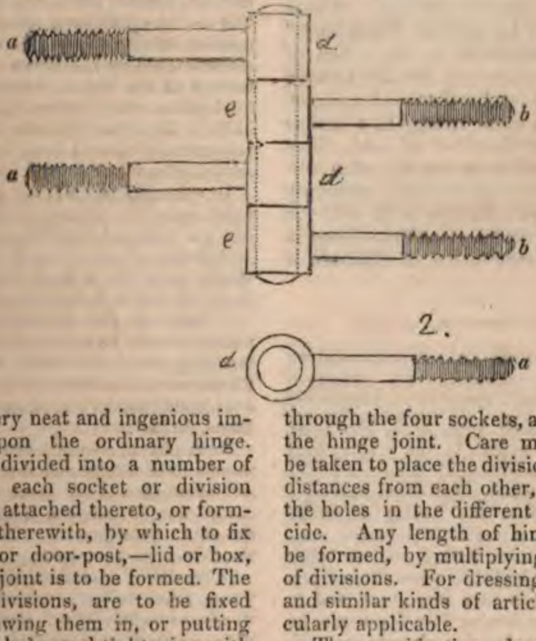
On some future occasion I will, with your permission, resume this subject, and show how this destructive chemical influence may be obviated in other arrangements, not less important to the interests of those concerned than the one here noticed.

Yours respectfully,

W. A. KENTISH.

EDWARDS'S IMPROVED HINGES.

[Patent dated, April 3. Specification enrolled, October 3, 1839.]



This is a very neat and ingenious improvement upon the ordinary hinge. The hinge is divided into a number of socket joints, each socket or division having a stalk attached thereto, or forming one piece therewith, by which to fix it to the door or door-post,—lid or box, for which the joint is to be formed. The sockets, or divisions, are to be fixed (either by screwing them in, or putting them through holes and tightening with a nut,) alternately one in the door, and the next in the door post, and so on. Thus, suppose the stalks and sockets, *a d*, to be screwed into the door post,—and the stalks and sockets, *b e*, into the door, the pin, or pivot *c*, passes down through the four sockets, and thus forms the hinge joint. Care must of course be taken to place the divisions at accurate distances from each other, so as to make the holes in the different sockets coincide. Any length of hinge may thus be formed, by multiplying the number of divisions. For dressing cases, desks, and similar kinds of articles it is particularly applicable.

The specification describes various methods of fixing the sockets, and some modifications of the hinge to suit particular cases, but the foregoing explanation fully exemplifies Mr. Edwards's invention.

PATTISON AND LOSH'S MODE OF MAKING OXIDES OF LEAD AND ANTIMONY.

[*Patented April 3. Specification enrolled, October 13, 1839.*]

Messrs. Pattison and Losh state their invention to consist in producing oxides of lead and antimony by first reducing these metals to the state of chlorides.

The broken lead ore is to be put in a wooden vessel lined with lead, then muriatic acid, of the strength of 1.10. is to be poured thereon. The vessel is closed air-tight—and the heat of steam applied until the whole of the ore has been reduced to the state of chloride of lead. The sulphuretted hydrogen evolved in this process, when sulphuret of lead is operated upon, is to be conveyed from the vessel by a pipe or other suitable means. The chloride of lead is then to be dissolved in hot water and lime, cream of lime or other earthy matter is to be thrown into the solution, by which the oxide of lead will be precipitated: about 60lbs. of unslaked lime are necessary to 100 lbs. of chloride of lead. By this process the sulphur of the ore is obtained in a state fit for use. Where the oxide is to be used as "blue lead," it must be submitted to the action of heat in a reverberatory furnace as with the oxide obtained by the usual process.

Antimony is to be treated in a similar manner to that described of lead. The chloride of antimony having been obtained, and dissolved in water, antimony itself will be precipitated; or if oxide is desired, about 60lbs. of unslaked lime is necessary to every 90 lbs. of chloride of antimony.

NOTES ON VARIOUS INVENTIONS—SMOKE CONSUMING—ILLUMINATING CLOCKS—PLANISPHERES—ANCIENT FIRE-ENGINE.

Sir,—About four years back, Mr. Isaac Milburn, a mill-wright, in the employment of my father, accidentally discovered (the fact being new to him,) that steam entering a chimney prevented the issuing of smoke from its orifice; it was in the following manner: in a small room is fixed an iron boiler in which flesh is boiled for dogs; the effluvia from the steam is very unpleasant, and to prevent it from issuing into the room, he carried a flat wooden flue close to the wall, from the side of the top of the boiler, into the chimney about 3 feet above its throat, after fixing this flue he went away about other business; having been absent an hour or two, he returned, and as he walked back cast his eyes to the chimney top, and seeing no smoke issuing from the orifice thought the fire had gone out—however, when he examined it, the fire was burning well, and *continued* without smoke as long as steam *entered the chimney*.

The ease with which modifications can be made by any inventing mechanic of the methods of preventing smoke from issuing from the chimney or funnel orifice, by steam entering the furnace or flue, or by first cokeing the coal in the furnace, must render the numerous patents for those two methods of very little value; being old discoveries, any person can employ the principles without infringing any patent right.

In vol. xxxi, page 320, of your instructive Magazine, in the Notes and Notices, an account is given of a new contrivance to illuminate the face of the clock at the Horse Guards. When I was at Glasgow in the year 1826, the same method was employed to illuminate the face of the clock of the Tron church with carburetted hydrogen-gas, by reflection.

In vol. xxxi, page 70, a planisphere is mentioned as a new contrivance: I have had one for several years, the following is its title:—"An horizontal sphere, showing the position of the heavens at any given time, manufactured by I. Addison and Co., globemakers to his Majesty George the Fourth, 50, London-street, Fitzroy-square, April 10th, 1824." It performs all the operations that your correspondent's does, and is made exactly similar to the description given by him.

In vol. xxx, page 87, is a description and wood cut of an ancient fire-engine, copied out of a work published in London, in 1590. A brother of mine lately returned from Rome, gave me a book which he bought there, of the following title and date:—

"Theatrum Instrumentorum et Machinarum Jacobi Bessani Delphinatis, Mathematici ingeniosissimi: Cum Franc. Beroaldi Figurarum declaratione demonstrativa. Lugduni, apud Barth. Vincentium, cum Privilegio Regis, 1578."

In this book, amongst numerous excellent wood cuts of mechanical inventions, is a cut and description of the same fire-engine, but the working details are much clearer than the cut in your journal. The following is the title of the plate:—

PLATE 52—"MACHINA MENTUM UT NON VULGARE SICUI OPINAMUR ITA SINGULARE IN EIA CULANDA AQUA ADVERSUS INCENDIA; MAXIME CUM FLAMMA SUPERANTE, NULLI PROPIUS AD ÆDES PATET ADITUS."

Yours faithfully,

ARTHUR TREVELYAN.

Wallington, October 9, 1839.

ON CASE-HARDENING IRON.

Sir,—I am particularly obliged to your correspondent "*Iota*" (page 479) for calling my attention to the article on case-hardening with prussiate of potass, which appeared in

your 664th number, as it carries the discovery back antecedent to the dates to which I had hitherto been able to trace it. At the same time, I beg to say, that the article had altogether escaped my notice, and I little thought, while drawing up the communication which appeared in your 836th number, that it would prove to be nothing more than an old friend with a new face.

However, I happen to know, that in consequence of the first notice having escaped the ken of many persons interested in this process, my resuscitation of the matter has in several instances been highly beneficial.

I also beg to return my sincere thanks to C. T. Coathupe, Esq., for his very friendly notice, and also for his kind intentions towards me otherwise expressed. I am aware of the occasional employment of sal ammoniac for case-hardening iron, but I believe it is only where the greatly superior method of using prussiate of potass is not known. The effect produced by the former substance is much inferior, both as to the hardness and thickness of the coating, to that obtained from the latter. Besides which, the sal ammoniac scales the surface of the iron so much, that in articles requiring to be highly polished, its use is almost inadmissible. I have been informed of a manufacturer who tried the sal ammoniac for case-hardening his patent axles, but was obliged to abandon it in consequence of the increased labour requisite for their polishing, and he fell back upon the old method of cementation. He has recently tried the prussiate of potass, and has found it eminently succesful; the surface thus given to the iron being susceptible of an exquisite polish with comparatively little trouble.

With respect to the flowing of the fused prussiate on to the surfaces not required to be hardened, I fancy a little skill on the part of the workman will be sufficient to guard against this, and perhaps some protecting coating may be applied to the part of the surface, where it is of consequence to avoid the hardening influence of the salt.

I remain, Sir, yours respectfully,

WM. BADDELEY.

London, October 11, 1839.

ON AEROSTATION.

To Mr. W. H. Weekes,—Sir, I have not had an opportunity of answering your last letter, before the present time, or I most certainly would have done it sooner. You proposed to attach the pipe to the balloon by two discs of wood, each 3 feet diameter, which would have a circumference of 9.42 feet, or 113 *inches; now I have taken a piece of the strongest lutestring I could meet* with, 6 inches wide, and 12 inches long; this I sewed with very fine strong twine, at each end, to two pieces of wood; I then suspended one of the pieces to a beam, and attached a spring balance to the other piece, and by increasing the weights, suspended from the balance, I found it tore completely across, at the parts where it was joined to the wood, with 12 lbs. weight; now if 12 lbs. will tear 6 inches asunder, then in the same ratio, 452 lbs. will tear 226 inches, the number contained in the 2 discs; but you have a weight of 1,409 lbs. which ought to be supported, by this surface of 226 inches, and you will therefore, be minus the means of supporting 957 lbs.

I am well aware that it is quite common, and also quite necessary, to leave at least one-third of the balloon without gas; but if you diminish the quantity of gas in the balloon, you diminish the ascending power at the same time, and in the same proportion; and instead of your 40 feet balloon, having an ascending power of 1,469 lbs., it would only have ⅔ds of that power, or 973⅓ lbs., which would not be enough to raise the apparatus alone, leaving the aeronauts out of the question.

As I think it is needless to point out any other objections to the scheme, until these are fully answered, I have refrained from so doing; meantime,

I remain your humble servant,

TANGAR.

THE ATLANTIC STEAMERS.

Sir,—Will you allow me a corner in your next, just to observe that the intended main point of my remarks on Mr. Hall's explanation of the damage done to the *British Queen's* boilers, has been, (owing perhaps to my own want of clearness of expression,) overlooked by you, and—followed eagerly in your wake,—by Mr. Hall. That gentleman spoke of the water having been blown out "*too low*" on the occasion in question. It was the operation of blowing out *in excess* that was complained of, and not the operation *per se*: hence it seemed perfectly natural to infer that the "blowing out" proper was in the usual course of things, *ergo*, injection-condensers were *used*, as well as fitted on board the *Queen*. This, indeed, is the conclusion to be drawn from the whole tenor of the paragraph; but the phrase "blowing-out *too low*" is the great clincher of the whole. Besides, "Piston" has drawn precisely the same inference from the premises, (vol. xxxi, p. 435) and Mr. H. has tacitly acquiesced in that view of the matter too long to be able to take shelter now under the wing of a merely hypothetical editorial paragraph.

Friend "Bowsprit" is quite incompre-

hensible; the extract from the log he produces is sufficient in itself to prove what I asserted, *i. e.*, that the *Queen* arrived "early in the morning of the 15th of August," (not 16th as "Bowsprit" ingeniously misquotes). The log says the voyage was "13½ days to Portsmouth." As the vessel started at 2 P.M., on the 1st of August, it needs no divination to discover that, according to this quotation of "Bowsprit's" own, she must have arrived at 2 A.M. of the 15th. The transparency of "Bowsprit's" figment is therefore only increased by his second letter, and his attempt to lower the flag of the *Great Western* has signally failed. Singularly enough, while this discussion has been going on, the *Great Western* has arrived in her usual time (12½ days), while the *British Queen* has exceeded her wonted lengthy period, and "the cry is *still she comes*." Another trip or two will probably settle the question of comparative excellence as satisfactorily as a whole ream of controversy.

I remain, Sir,

Your very obedient servant,

OBSERVATOR.

October 16, 1839.

EXPERIMENTS UPON FORMING COPPER PLATES FOR PRINTING, MEDALS, AND OTHER METALLIC DESIGNS, BY GALVANISM. BY MR. THOMAS SPENCER.

The application of electricity to the purposes of the arts and manufactures is but in its infancy,—and every day unfolds some new object attainable by its subtle and powerful agency. We some months ago published a description of one mode of printing from galvanised plates, communicated to us by a Mr. Jones, and several notices have appeared in various journals, hinting that Professor Jacobi, of St. Petersburg, had succeeded in copying engraved plates by precipitating the particles of a cupreous solution upon them, and thus taking an exact transfer of their surfaces. Mr. Thomas Spencer, of Liverpool, has, it appears, for two years been engaged in experiments of a similar nature to those of the Russian professor, and in consequence of the degree of publicity given to the discovery by him, Mr. S. has been induced to lay the whole details of his experiments, and mode of operation before the public; from these it appears *evident that* he has arrived at a far more *advanced stage towards perfection* than *his foreign competitor.*

From the prefatory portion of Mr. Spencer's pamphlet we gather some very curious particulars of the way they manage matters in the sectional exhibitions of the British Association. The novelty and importance of this discovery (had these points of the matter been looked to instead of the name of the author) certainly rendered it worthy of the attention of the meeting, even although its "author was quite unknown" to the scientific world. The General Secretary, Professor Phillips, doubtless, did reasonably and impartially look at the subject of the communication when he was applied to by Mr. Spencer in the first instance, and placed it first on the list of the articles to be submitted to the mechanical section;—but he was overruled by Dr. Lardner, who, it appears, merely looks at the *name* of the communicator, and when it is unknown, decides that if he can help it, it never shall be known, and that the paper should not be brought forward. It is fortunate for the interests of science and common sense that there are other means of publishing a discovery than those afforded by the British Association. It appears to us that Mr. Spencer's case is one which came exactly within the original declared design of the Association to take up and foster. Its very characteristic, that of a peripetetic association, was held forward as most likely to be beneficial, in tending to draw forth local talent. Here then is local talent, evinced in a striking degree, applying to, and rejected by, this very Association which ought to have cherished it! We hope that the members will, before the Glasgow meeting, make arrangements to prevent the recurrence of such flagrant instances of carelessness (to say the least,) on the part of their officials, which can have no other tendency than to strip from the Association the thin film of utility that now covers it, and to bring it into thorough contempt.

The Liverpool Polytechnic Society, (a very useful and flourishing local institution, to the papers communicated by whose members we have several times been indebted) have done well to take the matter up with energy, as they have done. Mr. Spencer's pamphlet, from which the following details are extracted, is published under their auspices.

The priority of invention it clearly appears must be conceded to Mr. Spencer, in opposition to Professor Jacobi, who has not even yet, as far as we have heard, with the help of the Emperor's grant of money to carry on his experiments, been able to produce a plate capable of being printed from.

We must now proceed to the experimental details.

In September, 1837, (says Mr. Spencer,) I was induced to try some experiments in electro-chemistry, with a single pair of plates, consisting of a small piece of zinc and an equal sized piece of copper, connected together with a wire of the latter metal. It was intended that the action should be slow; the fluids in which the metallic electrodes were immersed were in consequence separated by a thick disc of plaster of Paris. In one of the cells was sulphate of copper in solution, in the other a weak solution of common salt. I need scarcely add that the copper electrode was placed in the cupreous solution. I mention this experiment, briefly,—not because it is *directly* connected with what I shall have to lay before the society, but because, by a portion of its results. I was induced to come to the conclusions I have done in the following paper.* I was desirous that no action should take place on the wire by which the electrodes were held together. To attain this object I varnished it with sealing-wax varnish; but, in so doing, I dropped a portion of it on the copper that was attached. I thought nothing of this circumstance at the moment, but put the experiment in action.

The operation was conducted in a glass vessel; I had consequently an opportunity of occasionally examining its progress. When, after the lapse of a few days, metallic crystals had covered the electrode, *with the exception of that portion* which had been spotted with the drops of varnish, I at once saw that I had it in my power to guide the metallic deposition in any shape or form I chose by a corresponding application of varnish, or other non-metallic substance.

I had been long aware of what every one who uses a sustaining galvanic battery with sulphate of copper in solution must know, that the copper-plates acquire a coating of copper from the action of the battery; but I had never thought of applying it to a useful purpose before. My first essay was with a piece of thin copper-plate having about four inches of superfices, with an equal-sized piece of zinc, connected together with a piece of copper wire. I gave the copper a coating of soft cement, consisting of bees' wax, resin, and a red earth—Indian or Calcutta red. The cement was compounded after the manner recommended by Dr. Faraday, in his work on chemical manipulation, but with a larger proportion of wax. The plate received its coating while hot. On cooling, I scratched the initials of my own name rudely on the plate, taking special care that the cement was quite removed from the scratches, that the copper might be thoroughly exposed. This was put in action in a cylindrical glass vessel about half filled with a saturated solution of sulphate of copper. I then took a common gas glass, similar to that used to envelope an argand burner, and filled one end of it with plaster of Paris to the depth of three-quarters of an inch. In this I put some water, adding a few crystals of sulphate of soda to excite action, the plaster of Paris serving as a partition to separate the fluids, but sufficiently porous to allow the electro-chemical fluid to penetrate its substance.

I now bent the wires in such a form that the zinc end of the arrangement should be in the saline solution, while the copper end should be in the cupreous one. The gas glass, with the wire, was then placed in the vessel containing the sulphate of copper.

It was then suffered to remain, and in a few hours I perceived that action had commenced, and that the portion of the copper rendered bare by the scratches was coated with the pure bright deposited metal, whilst all the surrounding portion was not at all acted on. I now saw my former observations realized; but whether the deposition so formed would retain its hold on the plate, and whether it would be of sufficient solidity or strength to bear working, if applied to a useful purpose, became questions which I now endeavoured to solve by experiment.

It also became a question whether, should I be successful in these two points, I should be able to produce lines sufficiently in relief to print from. This latter appeared to depend entirely on the nature of the cement or etching-ground I might use.

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* The experiment here alluded to was to determine a most important point—and as it has an intimate connection with the future application of the results detailed in this paper, I may be excused in briefly alluding to it here. In fact, no experiment can be made with any certainty, without keeping its results in view.

In September, 1837, at the Liverpool meeting of the British Association, a clever young demonstrator (Dr. Bird, of London,) asserted, that, in an experiment he had made, he had obtained crystals of pure copper *without* the intervention of a metallic nucleus to commence with. I doubted this at the time, as it was opposed to all former experience. However, I made several very careful experiments, following Dr. Bird's plan in all he stated; then varied them in order to give it every chance of success. The result was, that *no metallic crystallization will take place, unless a metallic or metalliferous nucleus be present.*

This last I endeavoured to solve at once. And, I may state, this appeared to be the principal difficulty, as my own impression then was, that little less than one-eighth of an inch would be requisite.

I then took a piece of copper, and gave it a coating of a modification of the cement I have already mentioned to about one-eighth of an inch in thickness, and with a steel point endeavoured to draw lines in the form of net-work that should entirely penetrate the cement, and leave the surface of the copper exposed. But in this I experienced much difficulty, from the thickness I deemed it necessary to use, more especially when I came to draw the cross lines of the net-work. When the cement was soft, the lines were pushed, as it were, into each other; and when it was made of harder texture, the intervening squares of the net-work chipped off the surface of the metallic plate. However, those that remained perfect I put in action as before.

In the progress of this experiment, I discovered that the solidity of the metallic deposition depended entirely on the weakness or intensity of the electro-chemical action, which I found I had in my power to regulate at pleasure, by the thickness of the intervening wall of plaster of Paris, and by the coarseness or fineness of the material. I made three similar experiments, altering the texture and thickness of the plaster each time, by which I ascertained that if the plaster partitions were *thin* and *coarse*, the metallic deposition proceeded with great *rapidity*, but the crystals were friable and easily separated; on the other hand, if I made the partition thicker, and of a little finer material, the action was much slower, and the metallic deposition was as solid and ductile as copper formed by the usual methods,—indeed, when the action was exceedingly slow, I have had a metallic deposition, apparently much harder than common sheet copper, but more brittle.

There was one most important, (and, to me, discouraging) circumstance, attending these experiments, which was, that when I heated the plates, to get off the covering of cement, the meshes of copper net-work invariably *came off with it*. I at one time imagined this difficulty insuperable; as it appeared to me that I had cleared the cement entirely from the surface of the copper I meant to have exposed, but that there was a difference in the molecular arrangement of copper prepared by heat, and that prepared by voltaic action, which prevented their chemical combination. However, I then determined, should this prove so, to turn it to account in another manner, which I shall relate in the second portion of this paper.

I then occupied myself for a considerable period in making experiments on this latter section of the subject.

In one of them I found, on examination, a portion of the copper deposition, which I had been forming on the surface of a coin, adhered so strongly that I was quite unable to get it off,—indeed, a chemical combination had apparently taken place. This was only in one or two spots, on the prominent parts of the coin. I immediately recollected that on the day I put the experiment in action, I had been using nitric acid, for another purpose, on the table I was operating on, and that in all probability the coin might have been laid down where a few drops of the acid had accidentally fallen. I then took a piece of copper, coated it with cement, made a few scratches on its surface until the copper appeared, and immersed it for a short time in dilute nitric acid, until I perceived, by an elimination of nitrous gas, that the exposed portions were acted upon sufficiently to be slightly corroded. I then washed the copper in water, and put it in action as before described. In forty-eight hours I examined it, and found the lines were entirely filled with copper. I applied heat, and then spirits of turpentine, to get off the cement; and, to my satisfaction, I found that the voltaic copper had completely combined itself with the sheet on which it was deposited.

I then gave a plate a coating of cement to a considerable thickness, and sent it to an engraver; but when it was returned, I found the lines were cleared out so as to be wedge-shaped, or somewhat in the form of a ▽, leaving a hair line of the copper exposed at the bottom, and a broad space near the surface; and where the turn of the letters took place, the top edges of the lines were galled and rendered rugged by the action of the graver. This, of course, was an important objection; which I have since been able to remedy, in some respects, by an alteration in the shape of the graver, which should be made of a shape more resembling a narrow parallelogram than those in common use; some engravers have many of their tools so made. I did not put this plate in action, as I saw that the lines, when in relief, would have been broad at the top and narrow at the bottom. I took another plate, gave it a coating of the wax, and had it written on with a mere point. I deposited copper on the lines, and afterwards had it printed from.†

In now considered part of the difficulties removed; the principal one that yet remained

† This plate was shown, and also specimens of printing from it.

was, to find a cement or etching-ground, the texture of which should be capable of being cut to the required depth,‡ without raising (what is technically termed) *a burr*, and, at the same time, of sufficient toughness to adhere to the plate, when reduced to a small isolated point, which would necessarily occur in the operation which wood engravers term cross hatching.

I tried a number of experiments with different combinations of wax, resins, varnishes, and earths, also with metallic oxides,—all with more or less success.

The one combination that exceeded all the others in its texture, having nearly every requisite, (indeed I was enabled to polish the surface nearly as smooth as a plate of glass,) was principally composed of virgin wax, resin, and carbonate of lead, the white lead of the shops.

With this compound I had two plates, 5 inches by 7, coated over, and portions of maps cut on the cement, which I had inintended should have been printed off and laid before the British Association at its meeting. I applied the same process to these as to the others—dipping them in dilute nitric acid before putting them in action; deed I suffered them to remain about ten minutes in the solution. I then put them into the voltaic arrangement. The action proceeded, slowly and perfectly, for a few days,—when I removed them. I then applied heat, as usual, to remove the cement,—when all came away as in a former instance; the voltaic copper peeling off the plate with the greatest facility. I was much puzzled at this unexpected result, but, on cleaning the plate, I discovered a delicate tracing of *lead*, exactly corresponding to the lines drawn on the cement previous to the immersion in the dilute acid. The cause of this failure was at once obvious: the carbonate of lead I had used to compound the etching ground had been decomposed by the dilute nitric acid, and the metallic lead thus set free had deposited itself on the exposed portions of the copper-plates, preventing the voltaic copper from chemically combining with the sheet copper. I was now obliged, with regret, to give up this compound—although, under other circumstances, I have no doubt it may be rendered available. I adopted another, consisting of bees' wax, common whiting, resin, a small portion of gum, and plaster of Paris. This seems to answer the purpose tolerably—though I have no doubt by an extended practice, a better may still be obtained.

I now proceed to the second, and I believe, the most satisfactory portion of the subject. Although I have placed these experiments last, they were made simultaneously with the others already described; but, to render the subject more intelligible, I have placed them thus.

I have already stated that I was desirous of executing metallic ornaments by this means, in either cameo or intaglio; but, being well aware of the apparent natural law which prevents metallic deposition by voltaic electricity *without* the presence of a metallic body, I perceived, in consequence, its uses, if any, would be extremely limited, as whatever ornament it might produce, it would only be by adhering to the condition of a metallic mould.

I accordingly determined to make my first experiment on a very prominent copper medal. I placed it in a voltaic circuit, as already described, and deposited a surface of copper on one of its sides to about the thickness of a shilling. I then proceeded to get the deposition off. In this I experienced some difficulty, but ultimately succeeded. On examination with a magnifying glass, I found every line was as perfect as the coin from which it was taken. I was then induced to use the same piece again, and let it remain a much longer time in action, that I might have a thicker and more substantial mould. I accordingly put it again in action, and let it remain until it had acquired a much thicker coating of the metallic deposition; but when I attempted to remove it from the medal, I found I was unable. It had apparently completely adhered to it.

I had often practised, with some degree of success, a method of preventing the oxidation of polished steel, by slightly heating it until it would melt virgin wax; it was then wiped apparently completely off; but the pores of the metal became impregnated with the wax.

I thought of this method, and applied it to a copper coin.

I first heated the piece, applied wax, and then wiped it so completely off that the sharpness of the coin was not at all interfered with. I proceeded as before, and deposited a thick coating of copper on its surface, after the lapse of a few days. When I wished to take it off, I applied the heat of a spirit-lamp to the back, when a sharp crackling noise took place, and I had the satisfaction to perceive that the coin was completely loosened. In short, I had a most complete and perfect copper mould of a halfpenny.

I have since taken some impressions with

‡ I have since learned, from practical engravers, that much less relief is necessary, to print from, than I had deemed indispensible; and that on becoming more familiar with the cutting of the wax cement, they would be enabled to engrave in it with great facility and precision.

the mould thus taken, and, by adopting the above method with the wax, I get them out with the greatest ease.

I was now of opinion that this latter method might be applied to engraving much better than the method described in the first portion of this paper. Being aware that copper in a voltaic circuit deposited itself on lead with as much rapidity as on copper, I took a silver coin, and put it between two pieces of clean sheet lead, and placed them under a common screw-press. From the softness of the lead, I had a complete and sharp mould of both sides of the coin. I then took a piece of copper wire, soldered the lead to one end, and a piece of zinc to the other, and put them into the same voltaic arrangement I have already described. I did *not*, in this instance, *wax* the mould, as I felt assured that the deposited copper would easily separate from the lead, by the application of heat, from the different expansibility of the two metals.

In this result I was not disappointed. When the heat of a spirit-lamp was applied for a few seconds to the lead, the copper impression fell easily off. So complete do I think this latter portion of the subject, that I have no hesitation in asserting that facsimilies of any coin or medal, no matter of what size, may be readily taken, and as sharp as the original. To further test the capabilities of this method, I took a piece of lead plate, and stamped some letters on its surface to a depth sufficient to print from in relief. I deposited copper on it, and found it came easily off.

I now come to the conclusion of my experiments on this subject. As I stated at first, my object was to deposit a metallic surface on a model of clay, or other *non*-metallic body—as, otherwise, I imagined the application of this principle would be extremely limited. I made many experiments to achieve this result, which I shall not detail, but content myself with describing that which was ultimately the most successful.

I took two models of an ornament, one made of clay, and the other of plaster of Paris; soaked them for some time in linseed oil; took them out, and suffered them to dry—first getting the oil clean off the surface. When dry, I gave them a thin coat of mastic varnish. When the varnish was as nearly dry as possible—*but not thoroughly so*, I sprinkled some bronze powder on that portion I wished to make a mould of. This powder is principally composed of mercury and sulphur. I had, however, a complete *metallic coating* on the surface of my model, *by which I was enabled to deposit a surface of copper on it, by the voltaic* method I have already described. I have also gilt the surface of a clay model with gold leaf, and have been successful in depositing the copper on its surface. There is likewise another, and (as I trust it will prove) a simpler method of attaining this object, but as I have not yet sufficiently tested the experiment, I shall take another opportunity of detailing the method.

*Addenda.**

To Engrave in Relief on a Plate of Copper.

Take a plate of copper, such as are in use among engravers. It is not essential that it should be highly polished.

Have a piece of copper wire neatly soldered to the back part of it, and then give it a coating of either of the cements already mentioned. This is best done by heating the plate as well as the wax; or to level the wax after it has had a coat, hold the back part of the plate over a charcoal fire, or a spirit-lamp, taking care to hold it level.

Then write, or draw the design on the wax, with a black-lead pencil or a point. The wax must now be cut through with a graver, or a steel point, taking especial care that the copper *is exposed in every line*.

It must now be immersed in dilute nitric acid—say, three parts water to one acid. It will at once be seen whether it is strong enough, by the green colour of the solution, and the bubbles of nitrous gas eliminated. Let it remain long enough to allow the exposed lines on the plate to be *slightly* corroded, that the wax (which gets into the pores of the copper during the heating process,) may be thoroughly got rid of. Practice will determine this better than any rules.

The plate is now ready to be placed in the voltaic apparatus (see engraving.) After the voltaic copper has been deposited in the lines engraved in the wax, the surface of the formation will be found to be rough, more or less, according to the quickness of the action. To remedy this, rub the surface with a piece of smooth flag or pumice-stone, with water. Then heat the plate, and wash off the wax groundwork with spirits of turpentine and a brush. The plate is now ready to be printed from at an ordinary press.

To Deposit a Solid Voltaic Plate, having the Lines in Relief.

Take a plate of copper, lead, silver, or type-metal of the required size, and engrave in it to the depth requisite to print from when in relief.

Contrary to ordinary engraving, the lines

* By this process, iron works that are required to be preserved from the weather may have a coating of copper given to them of any requisite thickness.

must be *flat* at the bottom, and as nearly as possible of the same depth. When so engraved, (should the plate be copper or silver,) heat it, and then apply a little bees' wax (what is termed virgin wax is preferable) mixed with a very small proportion of spirits of turpentine, and give the plate a coating of it. It may be laid on in a lump, and the heat of the plate should be sufficient to melt it. When on the eve of cooling, the plate should be wiped clean, and all the wax taken off, as sufficient will have entered the pores of the plate to prevent the voltaic copper from adhering.

Then solder a piece of copper wire.

The plate must now receive a couple of coats of thick varnish on the back and edges again (a preparation of shell-lac and alcohol does very well.) I prefer, if the plate is large, to imbed it with plaster of Paris or Roman cement, in a box the size of the plate, allowing the wooden edge of the box to project just as much above the surface of the plate as you wish the voltaic one to be. (Care must be taken to keep the engraved surface of the plate clean.)

It is now ready to be placed in the apparatus to be deposited on.

Should the plate be lead, or, what is still better, type-metal, the preparation of wax does not require to be given to the plate, as, when it is deposited on to the given thickness, applying heat is sufficient to loosen the plates.

To Procure Fac-similes of Medals, &c.

This may be done by two different methods; the one, by depositing a *mould* of the voltaic metal on the face of the medal, (having first heated it, and applied wax,) and then depositing the metal by a subsequent operation in the mould so formed.†

But the more ready way is, to take two pieces of milled *sheet* lead, cast lead not being equally soft,) having surfaces perfectly clean and free from indentation. Put the medal between the two pieces of lead, subjecting the whole to pressure in a screw-press.‡ A complete mould of both sides is thus formed in the lead, showing the most delicate lines perfect (in reverse). Twenty, or even a hundred, of these may be so formed on one sheet of lead, and are deposited by the voltaic process with equal or greater facility; as, the more extensive the apparatus, the more regularly and expeditiously does the operation proceed. Those portions of the surface of the lead where the moulds do not occur may be varnished, to neutralise the voltaic action, or a whole sheet of copper being deposited, the voltaic medals may afterwards be cut out.

A piece of wire must now be soldered neatly to the back of the leaden plate; it is then ready to be put in action.

[This applies to the formation of one side of a medal only. It requires extremely careful manipulation to form both sides; and, as I think there may be a better method than the one I have hitherto adopted, I defer stating it until I have obtained the result of an experiment now in operation.]

A Voltaic Impression from a Plaster or Clay Model.

This process is partially described in a preceding column; in addition to which, I may state, that when the plaster or clay ornament is gilt with gold-leaf, or bronzed, a copper wire should be attached to it, by running through from the back, until the point appears above the front surface, or level with it will be sufficient. The other end must then be attached to the binding screw connecting it with the zinc, in all respects similar to any of the foregoing methods.

To Obtain any Number of Copies from an already Engraved Copper-plate.

A copper-plate may be taken engraved in the common manner, the lines being in *intaglio*. Procure an equal-sized piece of sheet lead, lay it on the engraved side of the plate, and put both under a *very powerful* press; when taken out, the lead will have every line, in relief, that had been sunk in the copper.

A wood engraving may be operated on in like manner, as lead, being pressed into it, will not injure it.

A wire may now be soldered to the lead, then bed it in a box, and put it into the voltaic apparatus, when a copper-plate, being an exact fac-simile of the original will be formed.

In this process, care must be taken that the lead is clean and bright, as it comes from the roller in the milling process, and consequently free from any oxidation, which it soon acquires, if exposed to the atmosphere. It should be put in action as soon as possible after being taken out of the press.

Remarks on the Management of the Apparatus.§

Next to electro-magnetism, there is no branch of science that requires more dexte-

† It may be necessary to note, that the voltaic mould will also require the application of the wax.

‡ A common copying machine will serve the purpose for a small medal not having much relief. Should the medal be large, and in bold relief, it would be better to have a small portion of the lead cut out, or turned in a lathe, so that the medal might, to a certain extent, fit into the lead before being pressed up. This will prevent the injury of the medal, and give a rim to the fac-simile.

§ These observations are intended for the guidance, in the first instance, of those who are practically unacquainted with voltaic arrangements.

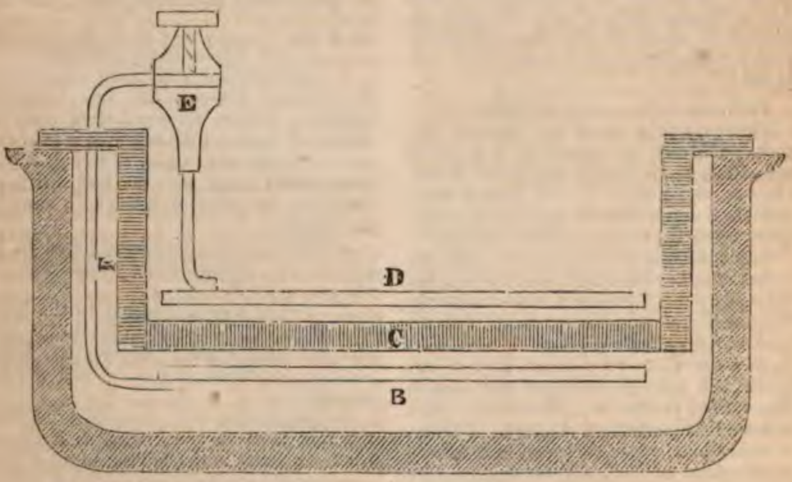
rous manipulation than voltaic, or electro-chemistry; the most trifling film of oxidation often retarding the action of the most powerful apparatus. But in the present instance, slow action, and simplicity of arrangement, being the predominating features, such nice attention to minutiæ is not absolutely necessary—or, at least, not so much so, as to deter those hitherto unacquainted with the subject from practising.

In *all* cases, to ensure the metallic connection, binding-screws are preferable to cups of mercury; but, in using them, the copper wire, where the attachment is made, must be brightened with a piece of emery paper,—also the point of the screw, where it presses on the wire. In soldering the wires to the plates, let as little resin be used as possible; sal-ammoniac, or dilute muriatic acid, answers the purpose much better.

In these experiments, I have invariably found an *equal-sized* piece of zinc to answer best. In the construction of galvanic batteries in general, I am aware, this is a moot point with high authority; but my own practice, which has been by no means small, with batteries of every construction, has led me to the opinion that, wherever slow and equable action is required, the positive and negative electrodes should be of equal *superficial* area. Although amalgamated zinc plates are preferable where combined intensity and continuity of action are required, they must not be used, under any circumstances, for the present purposes. It will, likewise, be found to be essential that the *thickness* of the zinc be equal to that of the required deposition.

Let the porous bottom of the interior vessel, containing the zinc, be a little larger than either of the electrodes. I have hitherto used, for this purpose, either bottomless glass cylinders, or varnished wooden boxes, with plaster bottoms; but I should recommend a well glazed earthenware vessel, having no bottom, but a slight rim projecting inwards, to secure the plaster. The zinc should be occasionally taken out of the arrangement, during the continuance of the process, and cleansed by washing it in water; the saline solution may also be renewed.

Fig. 1.



Crystals of sulphate of copper should be added, from time to time, to the cupreous solution; but, should the deposition require to be thick and long-continued, it will be necessary to take out the cupreous solution once or twice during the operation, and add *an entirely fresh one,—as the sulphuric acid, necessarily set free after the de-oxidisement of the copper, when it predominates to any* extent, prevents the required action from taking place on the copper; instead of which, a sub or di-oxide of copper is deposited, in the form of a reddish brown powder—the solution being rendered colourless. When this takes place, the plate should be taken out, and well washed in very dilute nitric acid. I have tried several methods to take up the sulphuric acid as it was set free;

pure clay answers this purpose pretty well, the acid combining to a certain extent with it, and forming a sulphate of alumina, or alum, at the bottom of the vessel.

When the voltaic wire is bent, it breaks at a similar angle to cast copper; but when heated to a red heat, and slowly cooled, it assumes somewhat of the pliability of rolled sheet copper, requiring to be bent several times before breaking; should it now be beaten on an anvil, it will resume its brittleness.

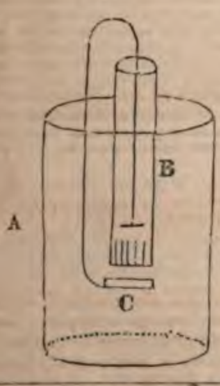
It may be filed, polished, and cut with shears, in the usual manner, the surface acquiring as fine a polish as the copper in use among engravers.

Should a thick mass of metal be requisite for any practical purpose, as it would require a considerable lapse of time before it could be obtained by the voltaic process,‖ the back of the deposited metal may be thickened, or filled up with solder, in a manner already practised in the arts, without the slightest injury to the surface or texture of the deposited metal.

Description of Mr. Spencer's Apparatus.

Fig. 1 is a section of the necessary apparatus, which may be made of any size. A, an earthenware vessel, containing a solution of sulphate of copper. C, an inner pan, of earthenware or wood, having a plaster of Paris bottom, made to fit into the interior of A, and containing a saline or acidulous solution. B, the plate to be deposited on; immersed in the cupreous solution, and having a wire, F, attached, which connects with the binding-screw E, soldered to the zinc plate, D, immersed in the saline solution.

Fig. 2.



‖ To deposit metal equal to one-eighth of an inch in thickness, requires eight or ten days' continuous action; the superficial extent of the deposition not being material, as regards the duration of the process.

Fig. 2 is a more simple apparatus, but on the same principle as Fig. 1. This is adapted for experiments on a small scale, or to take a fac-simile of a single medal. A, may represent a common drinking-glass, containing the copper solution. B, a gas-glass, having one end closed with plaster of Paris, and containing the saline solution. C, the plate or medal required to be deposited on, having a plate attached, to the other end of which is a piece of zinc, the wire being bent into the requisite form.

The accompanying engravings are copied from those produced, in relief, by the electro-chemical process described, the first result of that process appearing in print. It appears to have stood the working test of having been printed in Mr. Spencer's pamphlet, and in the *Liverpool Journal* newspaper. It is, however, by no means a fair specimen of what *may* be done by it. The lines were originally cut in a sheet of soft lead, hastily, and without reference to ornamental beauty of execution. The want of a tool properly adapted to cut the lead, accurately, in the required manner, has made the lines less regular in formation than they would otherwise have been. The letters were punched into the lead with types. The lead, thus prepared, was then put into the apparatus it illustrates, and a plate of copper deposited, the lines being in relief, which was printed off, accompanying the treatise.

MODE OF COPYING AND PRINTING OIL PAINTINGS.

[*From the Athenæum—Foreign Correspondence.*]

Before leaving London, I had heard of the invention by which Herr Liepmann, an artist of this city, professes to produce an unlimited number of fac-similes of ancient oil pictures, at a price almost miraculously low. A specimen or two of his handiworks, I believe, have already made their way to England, and some account of the artist, his struggles, and successes, has appeared in the French journals. Finding that his achievements were as fresh and constantly recurring a topic in every house here, as Lord Eglintoun's drowned pageant, or the new railroad to Potsdam, (by which every one has been enabled to play spectator to the recent military specuacles just over), I became naturally anxious to visit one, whose invention was none the less interesting, from its being coupled with a story, though the latter be merely (to man's credit) the old one of the triumphs of a fixed idea. It is as long as ten years, I believe, since the poor and obscure artist was first visited by the "notion" which he has only so lately perfected; and

during the interval, in spite of mockery and discouragement, he struggled on, industriously working at meaner trades to maintain himself, till, to quote his own words, he had brought home with him, from the Royal Gallery the Rembrant head he has copied,—hair by hair, hue by hue, and having thoroughly imbued his mind with its features and minutest details, had brought out those processes of manipulation, by which he is enabled to multiply his copies to any required extent. His only assistant was an orphan girl, whom he adopted in her infancy, and she is still the sole depositary of his secret. While we were talking to him, I could not but remark the bright and intelligent keenness with which her eyes followed us and took part in the discourse, as she loitered about the room, as if jealous lest, in some unguarded moment, some intimation of her protector's process should be revealed. I had before seen more than one of his copies; I now examined three narrowly, he standing by and answering my questions the while, with a modesty, and patience, and good-nature, as yet unspoiled by outward notice, or the internal more intoxicating consciousness of a life's dream fulfilled. The copies are produced (I know not whether I might say *struck off*) upon moderately thick pasteboard, which is saturated with colour and oil. From this saturation Herr Liepmann and other artists are disposed to augur a greater permanence for his works than awaits the originals, where the colour lies plaster-wise upon the surface of a canvass. It struck me as remarkable, that while that blotchy appearance, which is distinctive of Rembrandt's manner of handling his lights, is reproduced forcibly, there is, in reality, little difference in the thickness of the colour. Upon holding it up to the light, the picture appeared in most places semi-transparent. The mysteries, then, are the mixture and arrangement of the tints, the means of impressing them on the pasteboard, and of proportioning them to the desired number of impressions. Herr Liepmann would not own to there being any spoiled or imperfect copies, or any difference in the closeness of similarity between those first taken or the last. Believing that he has still much to accomplish by means of his secret, he is about to attempt, for his next subject, something smaller and more delicate. He showed me a study of a girl's head, with sea-green drapery, taken off on common paper, in which the tints were certainly sufficiently fresh and pearly to warrant confidence in *his ability* to produce copies of the Madonnas *and Mona Lisas of ancient art*, at the low *price of a louis a copy*. Great controversy *s been stirred up* among the artists here by this new art, but I have heard no dissentient voice respecting the exactness and fidelity of the works themselves. I must not forget the letter which Liepmann has received from his king,—very flattering and full of honour; it enclosed, moreover, two hundred thalers. He spoke of it with great pride, seemed to look hopefully to England for recognition and patronage, and then with a true touch of the Berlin *Gallo-phobia*, which I have hitherto detected oozing out in the talk of all, gentle and simple, remarked that none of his works had found their way as yet into France. To me, the artist was as interesting as his productions, which your eyes, as well as mine, will one day admit to be something extraordinary.

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 27TH OF SEPTEMBER AND THE 24TH OF OCTOBER, 1839.

Joseph Clinton Robertson, of Peterborough Court, Fleet-street, Patent Agent, for an improved method of manufacturing artificial marble. (A communication). Six months to specify; Sept. 27.

Henry James Pidding of Osnaburgh-street, Middlesex, artist, for improvements in collars for horses and other animals. (A communication.) Six months; Sept. 27.

Francis Maceroni, of Saint James's-square, Middlesex, gent., for improvements in steam boilers or generators. Six months; Sept. 27.

Thomas Robinson Williams, of Cheapside, gent., for certain improvements in the manufacture of flexible fibrous substances, or compositions, applicable to covering buildings, and other useful purposes, and also the machinery used therein. Six months; Feb. 28.

William Henry Burke, of Shoreditch for improvements in the mode of constructing vessels for containing air, applicable to the purpose of raising sunken, or lifting floating bodies under or in water; and of fastening such vessels to chains or other machinery, or apparatus to be used for raising or lifting such bodies. Six months; Oct. 3.

Job Cutler, of Lady-poole-lane, Sparkbrook, Warwick, for certain improved combinations of metals to be used for various purposes. Six months; Oct. 3.

Samuel Hall, of Basford, Nottingham, engineer, for improvements in machinery for propelling. Six months; October 7.

Francis Gybbon Spilsbury, of Walsall, Staffordshire, chemist; Marie Francois Catherine Doetzer Corbaux, of Upper Norton-street, Middlesex, and Alexander Samuel Byrne, of Montague-square, gent., for improvements in paints or pigments, and vehicles, and in modes of applying paints, pigments and vehicles. Six months; Oct. 7.

John Lothian, of Edinburgh, geographer, for improvements in apparatus for measuring, or ascertaining weights, strains or pressure. Six months; Oct. 7.

John Barnett Humphreys, of Southampton, C.E., for certain improvements in shipping generally, and in steam vessels in particular, or some of these improvements being individually novel, and some the

result of novel application, or combination of parts already known. Six months; Oct. 10.

James Smith, of Deanston Works, Kilmadock, Perth, cotton spinner for a self-acting temple, applicable to looms for working fabrics, whether moved by hand or power. Six months; Oct. 10.

James Smith, of Deanston Works, Kilmadock, Perth, cotton spinner, for certain improvements applicable to canal navigation. Six months; Oct. 10.

John Swain Worth, of Manchester, merchant, for improvements in rotary engines to be worked by steam, and other fluids, such engines being also applicable for pumping water and other liquids. six months; Oct. 10.

David Harcourt, of Birmingham, brass founder, for certain improvements in castors for furniture and other purposes. October 10; six months.

Robert Edmund Morrice, of King William-street, London, gentleman, for improvements in the manufacture of boots and shoes and coverings for the legs. (A communication.) October 17; six months.

John Dickinson, of Bedford-row, Holborn, Esq., for certain improvements in the manufacture of paper. October 17; six months.

John Coope Haddan, of Bazing-place, Waterloo-road, civil engineer, and George Hawks, of Gateshead, iron works, Durham, for certain improvements in the construction of wheels for carriages to be used on railways. October 17; six months.

James Yates, of the Effingham Works, Rotherham, iron founder, for certain improvements in the construction of furnaces. October 19; six months.

Charles Rober, of Leadenhall-street, cloth manufacturer, for improvements in fixing colour in cloth. October 19; two months.

William Newton, of Chancery-lane, civil engineer, for certain improvements in machinery or apparatus for making or manufacturing screws. (A communication.) October 24; six months.

James Sutcliffe, of Henry-street, Limerick, builder, for certain improvements in machinery or apparatus for raising and forcing water, or other fluids, and increasing the power of water upon water-wheels and other machinery. October 24; six months.

George Graydon, of Sloane-street, Chelsea, for certain improvements in instruments, for which letters patent were formerly granted to him, and which were called therein, "A new Compass for Navigation and other Purposes," part of which improvements are applicable to instruments for measuring angles at sea or on shore, by aid of reflection or refraction, or of reflection combined with refraction, and part are applicable to magnetic compasses for ascertaining true bearings from celestial observations, and for comparing the same with the bearing of the magnetic needle contained in such compasses, whereby to determine and be enabled to allow for the deviation of such needle from the true meridian, whether by variation, local attraction, or other cause of error. October 24; six months.

LIST OF SCOTCH PATENTS GRANTED BETWEEN 22ND OF SEPTEMBER AND 22ND OF OCTOBER, 1839.

Peter Lomax, of Bolton-le Moors, Lancaster, weaver, for certain improvements in looms for weaving. Sealed, 9th of October, 1839; four months to specify.

Joseph Garnett, of Haslingden, Lancaster, dyer, (communication from a foreigner), for certain improvements in machinery or apparatus for carding, drawing, roving, and spinning *cotton, flax, wool, and other fibrous materials. October 9.*

Joseph Davies, of Nelson-square, Surrey, gentleman, for a composition for protecting wood from flame. October 9.

William Edmondson and James Edmondson, both of Manchester, engineers, for certain improvements in the machinery or apparatus for the manufacture of wood screws and screw bolts. October 19.

Wilkinson Steele and Patrick Sanderson Steele, manufacturing and furnishing ironmongers, George-street, Edinburgh, for improvements in kitchen ranges for culinary purposes, and apparatus for raising the temperature of water in baths and other uses. October 18.

Robert Stewart, of North Woodside, near Glasgow, ironsmith, for an improved crane for raising stones or other heavy substances from quarries or other works. October 22.

Samuel Hall, of Basford, Nottingham, engineer, for improvements in steam engines and in propelling. October 22.

NOTES AND NOTICES.

Pape's Patent Table Pianofortes.—Amongst the objects of the fine arts admitted at the late exhibition of the produce of French industry, pianos were, unquestionably, the most remarkable. Sixty-seven masters sent to the exhibition nearly 200 pianos, amongst which were several of an entirely new shape: such as table, gueridon, ovalt hexagon, and consol. These new instruments are made at the manufactory of M. Pape, piano maker to the King, who also exhibited a square piano, which judges have justly considered as a master-piece of its kind. The latter is veneered with sheets of ivory, part of which is carved and inlaid, and forms a most beautiful mosaic design. M. Pape obtains these ivory sheets by means of spiral machinery of his own invention, which produces from elephant's teeth of an ordinary size, sheets of from twelve to fifteen feet in length, and two feet in width. This invention will, no doubt, be appreciated by miniature painters, to whom this mechanical discovery will be of very great advantage. M. Pape also exhibited an horizontal grand piano of a small size. The most remarkable improvement in this instrument is the sounding board, which is so disposed that the tension of the string stretches and keeps the sounding board level. The consequence is, that the sound improves in course of time, whilst in pianos of the ordinary const uction, the contrary will happen. M. Pape's new instruments have attracted the attention of the Royal Family, and her Royal Highness the Duchess of Orleans has purchased one of the table pianos for her own use.—*Musical World.*

Ornamental Bricks.—It is not generally known that all kinds of ornamental bricks may now be made without their being subject to more than double duty. This information may conduce to the reintroduction of the ancient style of brick-work which contributed so much to the beauty of the architecture of Henry and Elizabeth.

Pin-Making.—Messrs. John Edelston and Son, of Warrington, have just fitted up a large factory, in Lachford, called the Mersey Pin Works, which is to be entirely devoted to the manufacture of that useful and necessary article in ladies' dress—pins. It is decidly the largest manufactory of the kind in England, and, when in full work, will give employment to 1,000 men, women, and children. The number of pins now made there averages 15,000,000 or 16,000,000 per week.—*Manchester Guardian.*

Paper made of Sea Reed.—At a meeting of the Boston Society of Natural History, the President read a report on the specimens of paper and pasteboard manufactured from the Beach grass, and

presented by its inventor, Mr. Sanderson, of Dorchester. The plant is the *Arundo arenaria*. Lin. It is placed in the genus *Calamagrostis* by Withering and Decandolle, *Ammophila* by Hort and Hooker, *Psamma* by Palissot de Beauvais, Torrey, Eaton and Beck, *Phalaris* by Nuttall. It is called sea-reed or mat-reed, in England, and is found on all the shores from Iceland to Barbary, and all the Atlantic shores from Greenland as far south as New Jersey, at least. Its principal use therefore has been a negative one, connected with the very terms of its existence. It effectully secures the shifting sands on which it grows; and for that purpose large sums are annually appropriated by government, that by its cultivation important harbours may be preserved. The paper is smooth, soft, and pleasant to write upon, and takes ink well. It is firm and very strong, and may be whitened readily. The pasteboard appears to be specially valuable.—*Silliman's Journal.*

The Experimental Wood Paving in Oxford-street. The vestry of St. Marylebone having determined on paving with wood the whole of the carriage-way of Oxford-street, from Rathbone-place to Wells-street, being a space of 4,000 superficial yards, the Paving Committee met yesterday to consider the matter, and after considerable discussion it was resolved to invite all the known projectors of plans for wood-paving to lay down specimens of their different modes of performing the works within the above named space. A variety of specimens of wooden blocks, some of a most singular character and appearance, have already been deposited at the Court-house, and the committee have extended the time for those of other projectors to be sent in until Thursday next, when they will again meet to read the proposals, appoint the space to be allotted to each experiment, &c. The issue of these experiments will be conclusive as to the eligibility of wood paving for the streets of this metropolis, as this portion of the work will be subjected to the severe test of the wear and tear of Oxford-street for the space of one year. The experiment already laid down will then have been, at the termination of that period, subjected to a trial of two years, and the question of durability, slipperinesss, and facility of taking up and relaying after gas and water companies will all be determined.

Civil Engineering, King's College.—On Monday last a new and very important class of "manufacturing art and machinery," was opened to the students of this institution by Mr. Edward Cowper. It belongs to the department of civil engineering and science applied to the arts and manufactures, and arose from an acknowledgement of the want of a system of education suitable to young men intended for the profession of civil engineers. The subject having for a considerable time occupied the attention of the council, they arranged in the year 1838 a plan, which was then presented to the public, with the view of giving a scientific education to those who professionally or otherwise desired to obtain it. These views of the council having been fully justified by the success which has attended the measure, they decided upon incorporating with it a course of instruction, having a special reference to the arts and manufactures of the country, and with this view appointed Mr. Cowper the lecturer on manufacturing art and machinery. The objects of the lectures and instructions in this section are to familiarise the student with the machinery and contrivance in actual use, thus adding a knowledge of practice to the knowledge of theory taught by the professors. To effect these, machines will not only be described in general terms, but their various details, and the design of each particular construction, will be explained and illustrated by drawings or models. The observation, judgment, and invention of the students will be exercised by experiments made by themselves, and by visits to various manufactories and other works, to which access has been liberally granted by the proprietors and directors, and where they will be accompanied by the lecturer, who will give explanations on the spot.

Gas from Grapes.—An interesting experiment was made at Bordeaux, a few days ago, in the presence of the Mayor, on the husks of grapes, when pressed, and the lees of the wine, in order to show their use for the purposes of lighting. A pound of the dried husks put into a red-hot retort, gave, in seven minutes, 200 litres of gas, which burnt with an intense light, and free from smoke or smell. A second experiment with the dried lees was equally satisfactory.

Jacobi's Electro-magnetic Engine.—Dr. Jacobi, in a letter to Mr. Faraday, thus alludes to this subject:—"In the application of electro-magnetism to the movement of machines, the most important obstacle always has been the embarrassment and difficult manipulation of the battery. This obstacle exists no longer. During the past autumn, and at a season already too advanced, I made, as you may perhaps have learned by the gazettes, the first experiments in navigation on the Neva, with a ten-oared shallop furnished with paddle-wheels, which were put into motion by an electro-magnetic machine. Although we journeyed during entire days, and usually with 10 or 12 persons on board, I was not well satisfied with this first trial, for there were so many faults of construction and want of insulation in the machines and battery, which could not be repaired on the spot, that I was terribly annoyed. All these repairs and important changes being accomplished, the experiments will shortly be recommenced. The experience of the past year, combined with the recent improvements of the battery, give as the result, that to produce the force of one horse (steam-engine estimation) it will require a battery of 20 square feet of platina distributed in a convenient manner, but I *hope* that from 8 to 10 square feet will produce the effect. If heaven preserves my health, which is a little affected by continual labours, I hope that within a year of this time, I shall have equipped an electro-magnetic vessel of from 40 to 50 horse power."—*Athen.*

Mechanical-Playing Violin.—Decidedly one of the most ingenious musical instruments for years presented to the public, has been lately invented by Mr. Jenkins, the organist of Lurgan Church. The principle, though not altogether novel, is improved upon in a manner quite unique. It consists of a large violin body without neck or finger-board, placed horizontally on a frame, having a greater number of strings than the violoncello, which are acted upon by a bow, at the one end, and a key-board as in the pianoforte answering to the left hand of the violin player. The entire of the springs are at once under the movement of the bow, and to avoid the discordant effect which must ensue when a piano tone is required, any string is made removeable at pleasure from the touch of the bow, by the simple contrivance of a few treadles wrought with the foot, and connected with a damper in the inside of the instrument. One great beauty of the instrument is, that by the judicious disposition of the stops, each one produces the full chord of any key in which the performer thinks proper to play. The tone is most powerful; and from the vast variety of tones capable of being produced, it forms one of the best orchestral instruments which we have seen. The writer heard it accompanying a grand piano, and the tone of the latter in some instances was wholly drowned by the strength of Jenkin's instrument.—*Belfast News Letter.*

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 847.] SATURDAY, NOVEMBER 2, 1839. [Price 3*d*.

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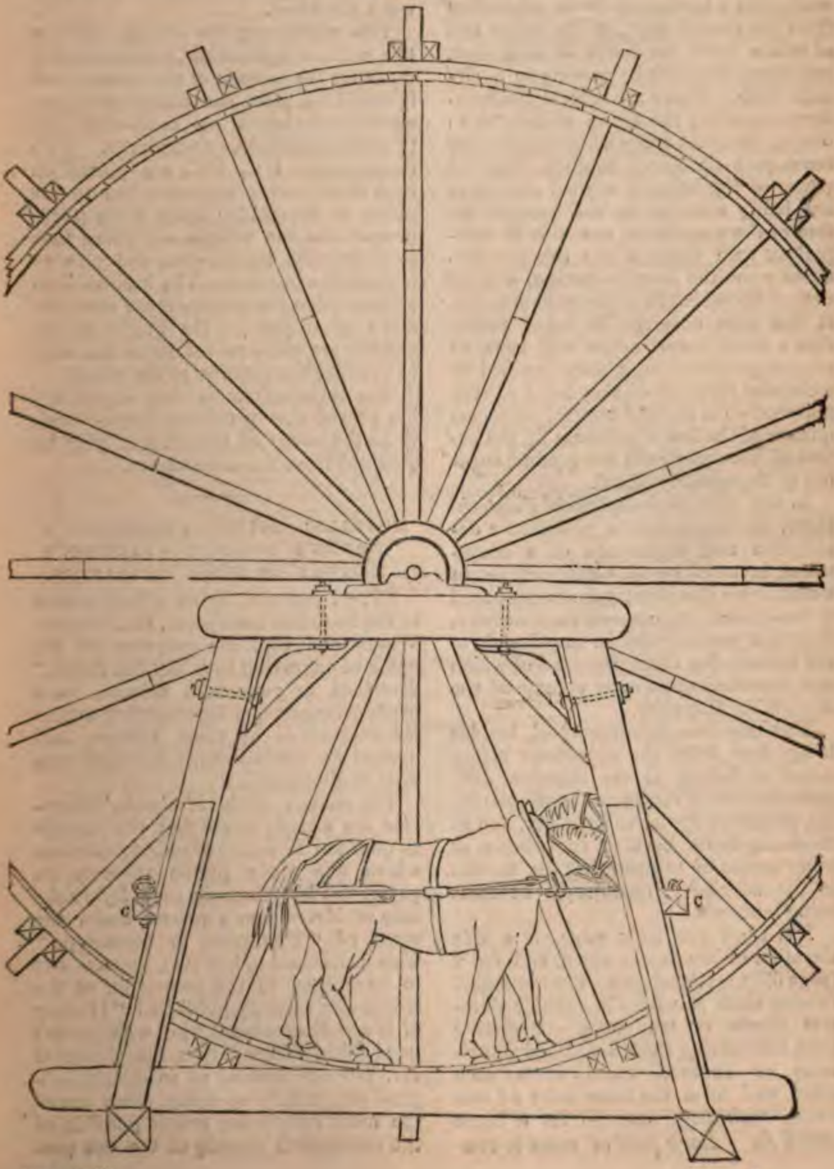
CHAMPONNOIS'S IMPROVED HORSE-POWER WHEEL.

Fig. 1.



CHAMPONNOIS'S IMPROVED HORSE-POWER WHEEL.

The common horse-mill consists of a vertical central shaft, turning in two trunnions, a barrel or toothed wheel placed upon this shaft, by which the poweris communicated through bands or other wheels to perform its destined work, and a horizontal lever projecting from the central shaft, to the outer end of which lever the horse is harnessed, and turns the shaft by moving in a circular path. There are several disadvantages attending the action of this mill; one is, the great space which the circular horse-path occupies; another, that the power of the horse is applied obliquely; and being cramped by the unequal action of the muscles of one side in comparison with those of the other, consequent upon the circular motion, a great deal of the strength of the animal is lost. It has been observed in horse racing that a small boned horse will have an advantage over a large boned animal in a circular race course, they being equally matched on a straight course, in consequence of the less abruptness of the action of the muscles in the gradual turning of the smaller animal.

In the *Recueil de la Société Polytechnique*, for March last, is published a description and engravings of a horse-wheel, invented by M. Champonnois, in which these disadvantages are proposed to be obviated; it possesses some novelty, although precisely similar in principle to the ancient dog turnspits—one of which was described in an early volume of the *Mechanics' Magazine*.

This new French horse-wheel, besides being free from the objections before stated to belong to the common mill, possesses the advantage of appropriating the weight of the horse as power, and of rendering fewer bevilled cog-wheels, or other means of transmitting the motion to the machinery, necessary,—its shaft being horizontal.

Fig. 1, on our front page, is a side elevation of the horse-wheel, and fig. 2 (page 67) a sectional plan. The horizontal driving shaft A, works in suitable plummer blocks or trunnions. Radiating from this driving shaft, are placed sixteen arms or spokes, which cross each other, and form the inner sides of two drums, each large enough for a horse to work in. Each pair of arms is connected by the cross piece B, attach-ed by iron pins. Upon these cross pieces are firmly bolted felloes, and floor pieces, sufficient in number to fill up the circumference of the wheel. The whole outer side of each wheel is strengthened by an iron rim bolted to the felloes. Each side is open to admit the horse to work the wheel.

This wheel may be erected between two walls, or against one, openings being made for the passage of the horses; but it would be most convenient as represented in the engravings, supported upon two wooden blocks or standards. Two cross-pieces, C C, C C, are placed on each side, fixed to arms attached to the pillars or standards; these cross-pieces project into the wheels and carry bars provided with hooks, eyes, and pins to harness the horses to. The harness is so adjusted that the whole of the strength, and a great part of the weight of the animals are made to act simultaneously to produce the rotation of the wheel.

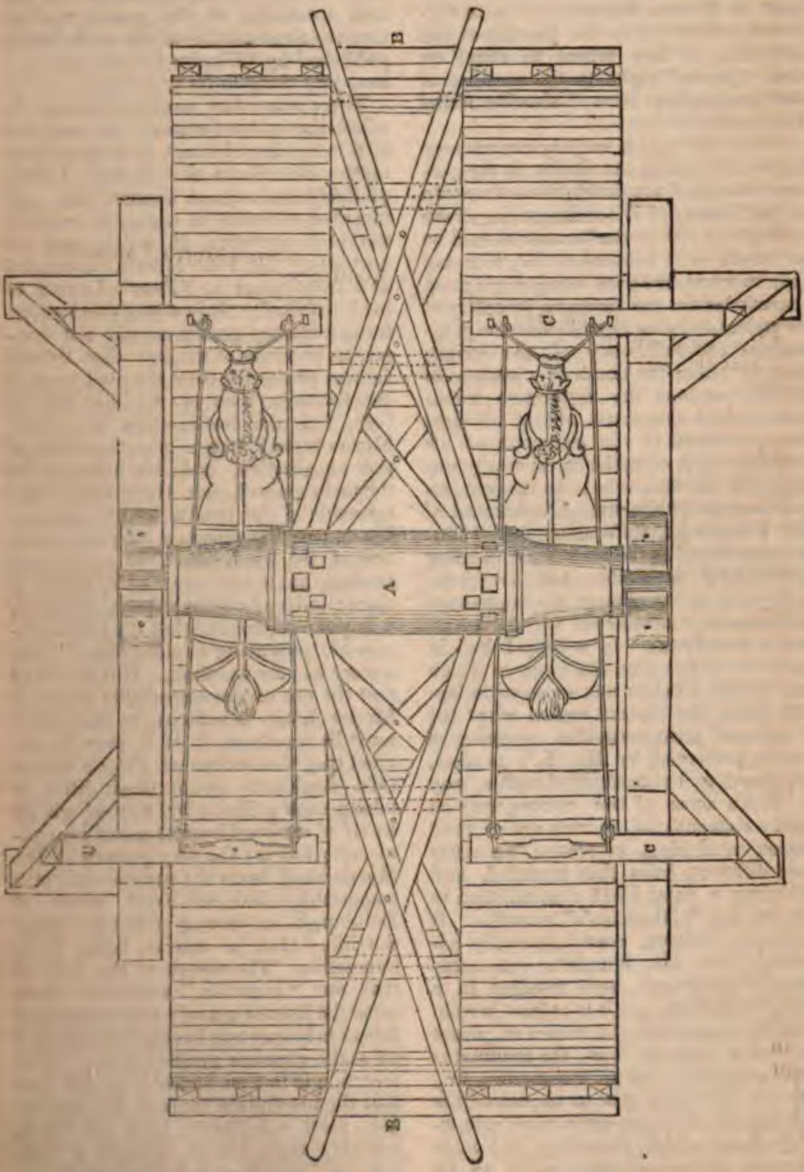
The inventor states that experience has proved that by this new horse-wheel, twice the power of the old mill may be obtained from the same horses.

METALLIC RELIEF ENGRAVING—WOONE'S PROCESS—JACKSON'S HISTORY OF WOOD ENGRAVING.

Sir,—I perceive by an advertisement in the *Scotsman* newspaper, that Messrs. Woone and Co., the patentees of the mode of engraving in "Metallic Relief," described in your 29th volume, have made arrangements for executing orders for engravings by their process, and opened an establishment for that purpose at Edinburgh.

The readers of the *Mechanics' Magazine* are already aware that the process in question is nearly identical with one which was made public through its pages, not less than six years *before* the date of Mr. Woone's patent, under the name of "Engraving in Stereotype." This information, however, appears not to have been in the possession of the writer of a recently-published "History of Wood Engraving," who, with perfect good faith, enters into a description of Mr. Woone's method as an entirely original one, and, in so doing, offers one of the most convincing proofs possible of the substantial identity of the two pro-

Fig. 2.



esses, his description of Mr. Woone's bearing throughout a most striking, in some places even a literal, resemblance to that given of the mode of stereotype engraving in the *Mech. Mag.*, of Feb. 4, 1832. It would therefore seem incumbent on Messrs. Woone and Co. to vindicate their claim to the priority of the invention, if they intend to stand on their "patent" right to the exercise of the process they term "Metallic Relief Engraving."

There has been a mighty controversy highly interesting, no doubt, to the parties concerned, respecting the authorship of the History of Wood Engraving above referred to. Why the honour should be so strenuously contended for, it is not easy to guess, the book being much more remarkable for the tiresome verbosity of its style, betraying in every line the pragmatical self-sufficiency of the writer, than for either the depth or clearness of its information; the illustrative woodcuts, indeed, constitute, out of all sight the chief part of the attraction of the volume. The compiler is especially unhappy in all that relates to modern improvements in the art. His account of Mr. Charles Knight's method of "Illuminated Printing," cannot boast of being particularly intelligible, and his panegyrics on its excellence are sometimes ludicrously contradicted by the specimens introduced. In a copy I had in hand the other day, the page in which our learned Theban was engaged in laying down the "plain reason why" the "register" must always of necessity be rigidly preserved by Mr. K.'s process, happened to be confronted with a map in which some of the colours were at least a sixteenth of an inch out of their places, producing, of course, an effect very different from that intended, and affording a point *blank* contradiction to the worthy "Historian's" remarks. It is now, I believe, pretty generally admitted, that Mr. Knight's well-intentioned endeavours have resulted in a complete failure, and it is at least certain that his maps, with the names of places printed in common type, the mountains represented by a few white scratches, &c., are not likely *very soon* to supersede the old-fashioned copper-plate maps *coloured by hand*, which, according to his *anticipatory advertisements, were to be cashiered at once. In the pages* of the work alluded to, however, all the supposed advantages of the scheme "live again in story," almost in the very words of the advertisements themselves, notwithstanding the general disappointment caused by the appearance of the first specimens of the grand process. Can the circumstance of the works being published by "Charles Knight and Co." have any thing to do with this?

There is another modern instance in which the author (whoever he may be) of this excellent history is laughably at fault. He tells us that Messrs. Lizars, of Edinburgh, about twenty years ago invented a method of engraving in relief, the best specimen of which was the portrait of "Dr. Peter Morris," appended as a frontispiece to "Peter's Letters to his kinsfolk." It is a pity this well-informed literary gentleman did not happen to be aware of the fact that Peter's Letters proceeded from the mad wags of Blackwood's, then in the hey-day of their fun and frolic,—that Dr. Peter Morris himself was a mere creature of the imagination, and his mansion of "Pensharpe-hall, near Aberystwith," not traceable in the county map! Messrs. Lizars may have made a splendid invention of the kind, but if so it is most strange that it has never been heard of since; under all circumstances, therefore, it is *quite as probable* that the grand process of "engraving in alto-relievo" was a piece of pure humbug. If it be urged that the use of the respectable names of Messrs. Lizars is sufficient to show there must be something in it, it may be replied that the author of Peter's letters (Mr. Lockhart) would think little of taking such a liberty by way of giving an air of *vraisemblance* to one of his real-seeming *bairns*; the very portrait of Dr. Morris itself bears the name in full of a respectable flesh-and-blood artist of Edinburgh, as having painted it from the life,—*that*, of course, being flatly impossible. The cream of the joke is that our "historian" swallows whole what the Doctor gravely says in his preface as to his portrait having been worked off at the common printing-press. This assertion is indeed fortified by the fact that the inscription beneath the portrait has, most indubitably, been set up in ordinary type, but it requires a very cursory inspection only, to satisfy an observer who knows anything of the

matter, that, however the portrait may have been produced and printed, (and it bears a suspicious resemblance to a common copper plate) the engraving and the type inscription below it, were never printed *together*. The obvious inference is, that the use of type was only a contrivance to heighten the mystification, and (horrible to relate) to take in such of the lieges as might be expected to make "Pensharpe-hall" a lion of their Welch tour, or pester the booksellers with enquiries for the first edition of "Peter's letters," which is *very scarce*. But only to think of so huge a gudgeon as the "historian of wood engraving," taking the hook—and after twenty years' interval too!

Whatever may have been the fate of Messrs. Lizars's grand invention, however, the numerous attempts now making to attain the same object bid fair to effect a great alteration in the "destinies" of wood engraving, or rather engraving in relief. Amongst others, the highly-ingenious process of Mr. Spencer, of Liverpool,—of which your last number furnishes so interesting an account,—promises to become of the utmost importance. The extreme slowness and delicacy of the voltaic action, it may be feared, will prove the greatest obstacles to its extended efficiency; but further experiment may do much to remove these drawbacks;— and, in any event, the cushioning of so novel and so excellent a process as that of Mr. S., by a body professing, like the British Association, to foster and encourage dormant talent, will assuredly lower, in a very great degree, the public appreciation of that "unrivalled travelling menagerie" of scientific *lions*.

I remain, Sir,

Your very obedient servant,

OBSERVATOR.

October 28, 1839.

PROSPECTS AND REQUIREMENTS OF COMMON ROAD STEAM-CARRIAGES.

Sir,—I may refer to many of your past volumes, for testimony to my often expressed conviction of the ultimate success of steam-carriages on common roads. Notwithstanding the discouraging progress of the *last three years*, like your *esteemed correspondent* "Junius Redivivus," I am "of the same opinion still;" although, up to the present day, I hold the task to be unaccomplished.

I believe nothing has so much retarde the successful progress of common road locomotion, as the absurd extravagances of many of its projectors. Too much has frequently been attempted: that is to say, too much power has been employed, too much weight has been carried, and too great a velocity has been sought after, in the infancy of this important science. Among the absolute failures from this cause may be noticed the carriages of Dr. Church, Mr. Roberts, Sir James Anderson, and some others.

I have often regretted that the uncompromising integrity of the ingenious Heatons should have induced them to abandon their enterprise in the eleventh hour. It is well known that, upon the strength of certain most astounding performances with an experimental carriage of moderate power, Messrs. Heaton had formed a company to work steam-carriages, which they undertook to furnish and to guarantee capable of performing *fifteen miles an hour*. On completing some carriages of the proper size and power, however, it was found that *twelve* miles an hour was the average rate of their performance, and Messrs. Heaton, consequently, declined entering into the contract. I believe the company would willingly have accepted the carriages at this reduced speed, but Messrs. Heaton were so little satisfied with that rate of travelling by steam power, that they abandoned the attempt, after incurring an outlay of several thousand pounds in obtaining thus much practical experience.

A review of what has been accomplished by Mr. Hancock on a very extensive, and by some others on a more limited, scale, would induce a belief that an average performance of twelve miles an hour, is all that ought at present to be expected; in a long series of practical experience, numberless improvements will, no doubt, present themselves in various parts of the mechanism, which, in combination, may ultimately ensure an increased pace. While observing the progress of Mr. Hancock in his late journey to Cambridge, I was particularly struck with the difficulties encountered, and the injury sustained, by the engine, in ascending and descending the

hills. It was the necessity for losing *time* (*and gaining power*) in ascending acclivities, that cut down the rate of travelling in Messrs. Heatons' last experiments to the average stated; as they found a slower speed needful for the ascent, while a compensating velocity on the descent could not be permitted without injury to the machinery. The very gist of their patented improvements in common road locomotives consisted in the facility with which the *power* or the *speed* of the carriage could be changed inversely. So that with the same pressure of steam, and a uniform rate of working in the engine, the power exerted upon the driving wheels was always proportioned to the work to be performed. This was accomplished, as I have already explained in your pages, by means of toothed gearing. In Mr. Hancock's arrangement of the machinery, perhaps, a chain working upon two reversed cones would give the opportunity required; but of this I am well assured, that no common road locomotive will ever stand any chance of success, which is not provided with some easy and effectual method for adapting the power of its engines to the ever-varying contingencies of uneven roads.

It appears to me that so much light has now been thrown upon this subject, by the numerous experiments already made, that if taken up in a proper spirit by those who are so deeply interested in its success, I feel confident that, in a comparatively short period of time, lines of communication on common roads would be opened, fully equal—in their peculiar province—both in utility and profit, to the lines of the railroad companies, and become formidable rivals both to them and to steam-boat proprietors.

I remain yours, respectfully,

WM. BADDELEY.

London, October 22, 1839.

RIDDLE'S SPIRAL-MOVED EVER-POINTED PENCIL.

An improvement in the ever-pointed pencil is a matter which comes home to *the pocket* of every man of business; and a very striking one has lately been put forward by Mr. Riddle, of *Blackfriars* Road.

The ever-pointed pencil, in its original form, consisted of a tube, within which the lead and its holder was moved, drawn in or thrust out, by means of an external ring connected to the lead-holder by a pin, working through a slot in the tube. This form was attended with several inconveniences; first, the slot or opening in the side of the tube weakened the case very considerably; second, the opening thus made allowed dirt to get inside the case and impede action; third, the pin attaching the external ring to the lead-holder, however well constructed at first, failed in the course of time, either getting loose and rickety, or else setting fast from the accumulation of dirt and dust within the case; lastly, the ornamental parts of the case were exposed to much injury from the friction of the sliding ring upon them. Mr. Riddle's spirally-propelled ever-pointed pencils are free from these objections.

The pencil is protruded from the case by the action of a spiral groove on one tube, in combination with a longitudinal groove on another. A stud, or pin, affixed to the lead-holder, and working through the spiral and longitudinal slots compels its progression or retrocession according to the direction in which the tubes are turned. The three tubes being fitted one within the other with mathematical accuracy, renders the pencil in its complete form almost solid. The idea of this improvement originated in England, and at first consisted in the propulsion of the point by a spiral movement working from the seal-top, but as the head was screwed on to the reservoir for leads, it continually happened that, in withdrawing the point, the head was unscrewed and came off, spilling the leads. This plan, imperfect as it was, became the subject of a patent in America, and it has since received the present neat and successful improvement in our own country by Mr. Riddle.

The tube or case of Mr. Riddle's spirally-propelled pencil, is divided about two-thirds of the way up, either end being connected with different internal tubes; the mere turning of one division on the other, sends out the pencil point, which, when done with, is withdrawn into its sheath by a turn or two in the opposite direction. It is one of the most useful and convenient, as well as one of the most compact and elegant writing instruments hitherto produced.

RUSSIAN VAPOUR BATHS.

Sir,—Looking over, a few days ago, vol. 1 of Dr. Granville's "St. Petersburg," I find he gives the following very faithful account concerning Russian baths :—

"I was shown into a lofty room, 10 feet long by 6 wide, which was divided at the end nearest to the entrance by a fixed wooden screen, half the height of the room, having a door in the middle, and leaving a sort of ante-room between the corridor and the room proper. In the latter we found a long and wide sofa, some chairs, a small table, and a looking-glass. The temperature of this room varies from 90° to 100°, it being readily diminished or increased, by opening the entrance door, or a small wicket in the window, or the door of the inner room, which is the bath-room, thereby admitting a certain quantity either of cold or heated air. The inner room has a wooden floor, is about 75 feet long by 33 wide, and of considerable height. In one of its angles there is a large stove, opening at its upper part inside of the room, with a door of large dimensions. The stove is heated from below, and the door in question stands before a large chamber filled with stones and iron shots kept constantly heated, and resting on a grating which separates the lower from the upper part of the stove. From the stove to the wall of the opposite side of the room, three wooden stages, brightly clean, are erected at different elevations, which, with a fourth placed at right angles with the middle stage, are reached by wooden steps. These stages or benches are about 6 feet long and 2 feet wide, with a scroll at one end to serve as a support for the head. On the floor opposite the door is a low dresser on which are displayed high-polished brass pans and wooden pails, kept in the utmost state of cleanliness; and under the lofty double windows is placed a cistern with two spouts which give out hot and cold water in abundance, and a brass tube rising between them to a height of 10 feet, bent horizontally at its upper extremity, and terminating in a round hollow and flat rose pierced with many holes, through which, by the turning of a small cock, water, either hot or cold, may be showered instantaneously and with considerable force. This is, in fact, the identical shower-bath which has lately been offered to the British public, under a patent and as a new invention by an ironmonger in Wigmore-street. The bath-room is seldom less than 120 degrees, and frequently from 132 to 140 degrees of temperature.

"The operation of bathing proceeds thus. The bather undresses in the *outer* room, *where he soon gets into a general perspiration. The heat, which at first appeared excessive*, becomes gradually more tolerable; nay, one soon gets anxious to experience a little increase. He is then invited into the bath-room, in which the *Parilstchick* or bathing youth, stripped of his clothing, has been for some time engaged in preparing a quantity of soap-suds and filling the various vessels with cold and tepid water. The temperature of the bath-room is so managed as to be kept from 10 to 15 or 20 degrees higher than that of the ante-room, and increases in proportion as we ascend to the highest stage or bench. The bather first tries the lowest stage for a while, on which he either sits or lies down; he next ascends to the second, where the heat felt is much more considerable; and if desirous to try a still greater degree of heat mounts to the stage not far from the ceiling, where upon trial I could not remain more than an instant. During the whole of this time the atmosphere of the room is generally clear, and being lighted by a lamp placed between the inner and outer sash of one of the windows is in no part obscure. The sensations at this period, before the perspiration is fully established, are unpleasant—the head feels greatly oppressed and burning—the skin is hot—the respiration difficult. The *parilstchick* now approaches to feel the state of the skin, and feeling it not quite overspread with perspiration, opens the front door of the stove, and, with force, throws into it a bucket full of water. Volumes of steam instantly pour forth from it into the room, and a thick fog pervades every part, bringing additional heat to the surface of the body, which breaks forth more quickly than can be stated, into a deluge of perspiration, when the breathing becomes natural, and the head clear and light, imparting at once such a general sensation of comfort as I can scarcely describe. In this state, and while the atmosphere gradually clears away, the vapours return into the upper part of the room, the bather lies down in a sort of apathy and general relaxation which are by no means disagreeable. The *parilstchick* next brings his large pan full of soap suds, and grasping, with both his hands, a quantity of the inner bark of the lime tree (commonly called bass) cut into fine slips, soaked in the soap suds, rubs every part of the body, softly pressing on every joint and bidding you turn whenever he thinks it requisite. After continuing this operation for some time, tepid or perfectly cold water, at the pleasure of the bather, is scattered over him as he lies, and lastly over the head and body generally while sitting. Some at this stage of the operation jump from the bench to the floor, and have cold water showered over them while every pore is open, without feeling any inconvenience; but I declined such

an experiment, perfectly well pleased with returning to the outer room, where I dried myself at leisure."

This brought to my recollection the minute and scientific experiments made many years ago by my late father, Mr. Rob. Hynam, when he was about forty years of age; he died in 1817, aged 81 years: during the whole of his long career he never ceased to occupy himself in mechanical and scientific pursuits. There is a specimen of his abilities now with the Society of Arts, &c., for which he received their gold medal; it is a very ingenious machine for gauging cutters for wheels, for the use of clock and watch makers.

If you think in your good judgment, the following experiments in a Russian bath, may be interesting to any of your very numerous readers, they are perfectly at your service; I give them to you in his own words.

I am, &c.

BENJAMIN HYNAM.

St. Petersburg, August 24, 1839, O. S.

Went to a steam bath in Moscow and made experiments in the following order:—Having before placed a barometer, a thermometer, a hygrometer, and suspended a second pendulum, September 10, 1775, between 7½ and 9 o'clock, P.M.

Barometer.

	in.
In the common air at 7 o'clock..	29.74
In the bath at the highest	29.77

Thermometers.

The extent of the scales above the freezing point was, in Delisle's 86°, in Reamur's 34°, in Fahrenheit 120°.

	D.	R.	F.
Thermometers in the common air at 7 o'clock..................	125¾.	13	61¼.
In the bath,...................................... Above division.			127
Whilst the bulb was under my tongue...........................			103
Between my hands..			103
Tied the thermometer round my neck, then flung cold water over my body			83

Hygrometer soon ceased to traverse.

Remarks on the Thermometers.

1st. By the intense heat, the mercury in Delisle's and Reamur's thermometers expanded so much that the bulbs broke.

2d. There is no doubt, but the mercury in Fahrenheit's thermometer would have risen higher had the tube been longer, for it rose the space of 7½° above the divisions. The thermometer was taken down for other experiments.

3d. The thermometer, when under my tongue, between my hands and blowed at from my mouth, was at the same distance from the ceiling as when suspended.

4th. Care was taken that both barometer and thermometer should be suspended, detached from the side of the room, that they might not receive any heat from what the wood has imbibed.

Beating of the Pulse.

Observed by a pendulum vibrating seconds.

		in a minute.
Before going into the bath		81
Half an hour after being in the bath		124
Three-quarters	ditto	140
An-hour-after	ditto	147
Half an hour after coming out of the bath.........................		103
An hour	ditto	96
Eight hours	ditto	87
Fifteen hours	ditto	79

Went to a bath in St. Petersburg, Dec. 19, 1775, and suspended a second pendulum. After being half an hour in the bath and using violent exercise, my pulse beat.... 182

A Russian who was present, and used very violent exercise, his pulse beat.......................... 185

He became very faint and went into the open air. A young man fainted away in the bath, and was carried out; prior to his fainting, he was desired to touch the plate of the barometer, he touched the nonnes which burnt the skin of his finger and thumb. He remained much affected for 14 or 15 days.

DAYLIGHT QUESTION.

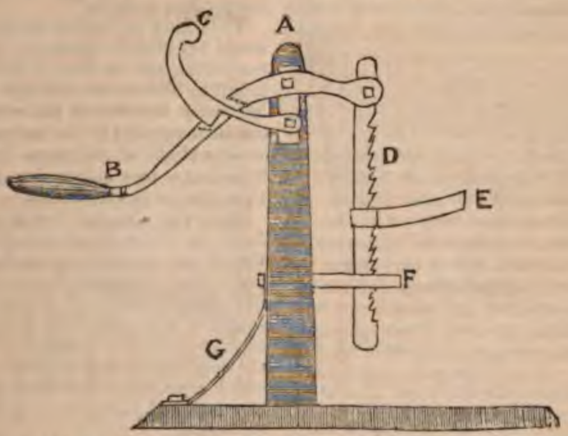
Sir,—Will any of your astronomical friends explain the cause of what appears to me to be a singular phenomenon.

Why in the month of October, and more particularly so in November, is daylight more vivid in the mornings than at hours equidistant from noon in the evenings, whilst the reverse is the case in the months of February and March?

A COUNTRY FARMER.

Watford, October 18, 1839.

IMPROVED CARRIAGE LIFTER.



Sir,—The sketch is that of a simple and portable carriage-lifter, (to enable the wheels to revolve when being cleaned), which I saw at the city of Brooklyn, Long Island, in 1835. A, upright post, four inches wide at the bottom, and gradually tapering to the top, two inches thick; B, main lever, with part removed to show the catch C; D, rack, 1¼ inch wide, to hold the iron E, which supports the carriage; F, guide for the rack: G, strengthening bracket.

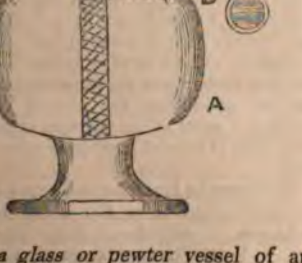
Yours faithfully,

ARTHUR TREVELYAN.

Wallington, Oct. 1839.

AMERICAN SPIRIT GAS LAMP.

Sir,—When at New York in 1835-6, I saw (much used in stores) a simple spirit-gas-lamp, similar to this sketch.



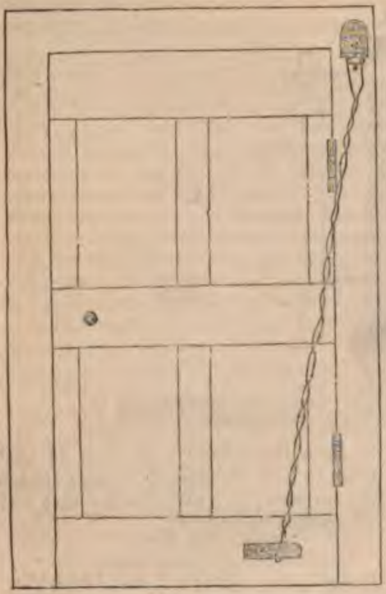
A, a glass or pewter vessel of any *shape; B, a brass cap* (to screw to a socket cemented to the glass); the top perforated with 5 holes, the size of those in an Argand-gas-burner; within the brass cap is soldered a short tin tube C, (shown by the dotted lines,) within this tube a cotton-wick D, rolled up thick is put, which wick reaches from the bottom of the lamp to the top of the tin tube; this wick supplies the spirit from which the gas is generated.

To light it, the copper-ring E (large enough to go over the brass cap) covered with small wire, and a wire attached for a handle, is dipt into the spirit, lighted. and put over the brass cap; in a few seconds the heat arising from the ignited spirit generates the gas, and inflames it as it arises through the perforations; the heat communicated to the brass-cap from the inflamed gas, is sufficient to continue the generation of gas as long as any spirit remains in the spirit holder.

Yours, &c.,

A. TREVELYAN.

SIMPLE DOOR SPRING.



This sketch exhibits a simple wire spring for causing a door to close of itself; I saw it attached to a door in the State House, Boston, N.A. in the year 1836.

Yours faithfully,

ARTHUR TREVELYAN.

Wallington, October, 1839.

METAL FOR SHEATHING SHIPS.

Sir,—In No. 844 of your Magazine there is an article on the above subject. It seems that when the brass "yellow metal" was first substituted for copper, too common, that is, too *poor*, a brass was used. This is a proof that the patentee was either over anxious to get rich by getting the article up as cheap as possible, so as to leave him a large profit, and then he ran the risk, by failure, of not getting rich at all, or else he was not fully aware that the *quality* of brass he was using was *unfit* for the purpose.

The patentee has powerful rolling mills in Birmingham, which are always in motion, flattening sheet metal for manufacturers, and although he may not have been sufficiently *acquainted with the mode of mixing* the best *sort of brass for the occasion*, his *workmen* [m]ust *have known that what he originally* employed for ship sheathing was not *ductile* enough "to be laid round angles, or into sharp-edged grooves."

The rollers on the first nip of the cylinders would tell them it would not do, that it was too brittle, had too large a portion of spelter mixed up with it, for although they do not ordinarily understand the mixing, no men can be more alive to the temperament of the various kinds of compound brass, because, in rolling it into sheets they have to vary their process in conformity.

This was also the reason why "it was found on taking it off the ships' bottoms, that it had perished, being full of minute pores, and crumbling between the fingers like gingerbread." The metal was supersaturated with zinc, and thus the galvanic action voraciously attacked one portion of the combination and oxidized or corroded it, which effect could have been previously ascertained and prevented by a few simple experiments.

It appears, however, that the mixture has been since improved, is said to be rendered now as ductile as is needful, is more durable than copper, six and a-half per cent. lighter than the sheathing of that metal, and is sold for three halfpence per pound less.

I have never seen the specification. The patent, however, could not be for *mixing* either the former or the latter metal, because both these, and twenty other graduated qualities of brass, were combined by tons' weight, weekly, before the patentee started into existence. This he is quite cognizant of, for the greater portion of them have passed through the hands of his workmen daily, during his father's time. It must, therefore, be confined to his using the metals for that specific purpose, or rather to the proportions of the two metals, which he uses. If he claims the combination of the particular metal as well, he is certainly not entitled to an exclusive privilege on that point; but for bringing it into use as *sheathing*, he has, and there is a great deal of merit in it, because *it is an improvement* on copper alone.

The reason is this:—The mixture of the two metals occasions a galvanic action which keeps the bottoms of vessels clean, and thus prevents any impediment in the uniformity and rapidity of their sailing; but "60 parts of copper, and 40 parts of spelter" are not the best proportions for securing this effect, nor for producing the utmost ductility, which is a point of considerable importance. It is what is termed carriage or coomb brass, only.

A mixture of brass sheathing may not only be made superior to the above in every particular, at the price given for what is at present in use, but a mixture of a different sort of metal, answering all the same pur

poses, may be produced for *four-fifths* of the price paid for the "yellow metal."

W. A. KENTISH.

REMARKS ON THE PROCESS OF PHOTOGENIC ENGRAVING.

Sir,—I have been for some months past very desirous of sending you a communication on this subject; but could not spare time, as all my leisure has been devoted to constructing galvanic batteries, and trying experiments on electro-magnetism. But my attention was called back again to the subject of photography, by reading this day in the 845th Number of your valuable Magazine, an account of Dr. Donné's discovery; having myself bestowed a good deal of thought and study upon this matter, as may be seen by my former communications, and as the doctor's method of operating is not described, you will, Mr. Editor, I hope, have the goodness to insert in your interesting journal these few lines containing my ideas and suggestions how the process may be accomplished. It is observable that the silver-coated copper plates, upon which the photogenic drawing has been produced by M. Daguerre's process, are rendered visible by the fumes of mercury; it is evident, therefore, that the drawing itself consists of an amalgam of silver and mercury; so that if it be desired to print impressions from such a plate without actually deepening the drawings with the graver, it will be more properly a photogenic etching, rather than an engraving. In which case we might either make use of such chemical re-agents as would more firmly fix, harden and consolidate the amalgam upon the surface of the metallic plate; or otherwise, by using such saline, or acid solutions, &c., as having a stronger chemical affinity for the mercury than for the silver, would, without the aid of friction or abrasion cause the amalgam to separate from the silvered surface, leaving in either case, the delineations perfect: so that in one case the impressions might be taken off, as from the lithographic plate drawing, and in the other case, as in printing from an etched or engraved plate; only that I believe there will be very little depth of line in such photogenic etchings, and that the delineations would soon be worn off the photogenic plates, and moreover, that their principal use will be to transfer correct drawings of the works of art, or of nature to the lithographic stone, whereby they may be multiplied at pleasure. Many persons interested in modern discoveries, and more particularly those connected with the fine arts, will no doubt wait with impatience the time when Doctor Donné shall think good to make public his methods; and when he does, I now venture to predict that they will find that this letter contains the substance of his processes.

In conclusion, I beg leave to remark, that the British government holds out no recompense for ingenious inventions and discoveries, and that had I been certain of receiving any benefit or emolument, if even only to half the amount that M. Daguerre has received from the French government, I should many years ago have followed out my course of experiments on photography, and most likely should have forestalled that gentleman in perfecting the discovery; for when we consider his continual application for some years to that one project, we cannot help thinking he has been very slow in attaining to perfection therein.

I remain, Sir, yours most respectfully,

THOMAS OXLEY.

No. 3, Elizabeth-place, Westminster Road.
October 20, 1839.

DR. FORSYTH'S INVENTION OF THE PERCUSSION LOCK.

[*From the Aberdeen Herald.*]

It may be interesting to give a brief account, which we had from an acquaintance of Dr. Forsyth, of the origin and progress of his discovery. His attention was first directed to the subject, by hearing that the French, shortly after the commencement of the revolution of 1793, had attempted, although unsuccessfully, to substitute for gunpowder, which the want of saltpetre prevented them from making in sufficient quantity, a sort of powder made from the chloride of potash. Being engaged in chemical studies, he experimented on this substance, and found, as the French had done, that the powder made from it could not be used. In the course of his investigation, however, he produced a powder which was not only easily ignited by percussion, but also readily kindled common gunpowder. Here was the principle of percussion; and forthwith he went diligently to work, to construct a lock in which the flint and steel should be dispensed with. This he accomplished most ingeniously, in a variety of forms, and, in spring 1806, he was able to carry to London a fowling-piece with a percussion lock, acting on fulminating mercury, which performed tolerably well, and fully embodied the principle. After being seen by some friends and acquaintances, among whom was Lord Brougham, it was shown to Sir Joseph Banks and Lord Moira, then Master-General of the Ordnance, both of whom were highly pleased with it. Lord Moira sent for

Mr. Forsyth, and urged him to conduct some experiments at the Tower. At first he was rather unwilling, but Lord Moira obviated his objection, by writing personally to the Aberdeen Presbytery for leave of absence, and ordering the overseer of the Tower to furnish workmen, prohibiting all persons whatever from interfering with what was going on.

Mr. Forsyth commenced his experiments, and, after several attempts, succeeded at last in constructing a gun-lock and compounding a priming powder which answered still better than the fulminating mercury, and satisfied Lord Moira of the applicability of the principle to muskets. He was next instructed to ascertain whether percussion could be applied to guns, and a three-pounder was sent him to experiment on. Previous to this, there had been nothing said on the subject of remuneration, further than that all expenses should be paid; but as there seemed to be a probability of a considerable detention, it became necessary to have some arrangement. Lord Moira's proposal was that Mr. Forsyth should, of course, get his expenses; and, when he had completed his experiments, a suitable reward. He also promised that, besides paying the gentleman who officiated for Mr. Forsyth, at Belhelvie, a reasonable salary, he should be favourably considered, if he were a proper person, in the dispensation of the Crown patronage. This part of the stipulation shared the same fate as that relating to the "suitable reward" —neither was fulfilled.

Mr. Forsyth soon constructed a lock for large guns, and the invention was considered complete. The "suitable reward" remained to be settled, and Mr. Forsyth professed himself willing to accept the price of the gunpowder that would be saved to the government, in two years only, by the adoption of his plan. This was acceded to, and the ascertained sum, which was considered perfectly satisfactory, was about to be paid, when, as stated above, a change of ministry put an abrupt end to the negociation. With some difficulty, Mr. Forsyth obtained payment of his expenses; and returned home, chagrined, no doubt, at his disappointment, but we are satisfied still more so at the prejudice and folly of the government, in continuing, during the war, to use clumsy firelocks that wasted fully a seventh of the powder, and were not nearly so effective nor so constantly available as his would have been.

Of the merits of the percussion principle, it is not now necessary to speak; they are *sufficiently* vouched for by its universal *adoption among sportsmen*. The substitution *of copper caps for the ingeniously-contrived* magazine of priming, which forms part of Mr. Forsyth's plan, may by some be considered a simplification, but we doubt much whether it be an improvement. It certainly would be none as applied to military purposes. The desiderata there, as was stated by Lord Moira to Mr. Forsyth, were, that the lock should be used with safety— that it should be simple and easily managed —that it should kindle the charge of gunpowder with certainty—and that it should keep the charge free from damp. All these are fully accomplished by the musket-lock invented by Mr. Forsyth, which, as a piece of mechanism, independent altogether of the important chemical principle on which it acts, is exceedingly ingenious. If the Government are introducing percussion locks for any portion of the army, they ought to consider well whether Mr. Forsyth's perfected lock will not best answer the object they have in view. Their decision on this point may be of importance to the public service, although it cannot now affect Mr. Forsyth's interests. His patent, which was rendered useless to him, expired long ago, and the only way he can now be rewarded, is by the Government doing what they intended to do before, and by the sporting public taking up the matter with proper spirit. We trust our brethren of the press will aid in obtaining this piece of justice for a quiet, unobtrusive, respectable clergyman, who is not more admired for his ingenuity than he is esteemed for his amiable private qualities by all who have the pleasure of knowing him.

STEAM-TOWING ON CANALS.

Some further experiments have been made upon this plan of transit, under the direction of Mr. Macneill, on the Forth and Clyde Canal, particularly on the 10th and 11th ult. The locomotive employed was the Victoria, the same engine that had been used in the former trials. By her were towed both the passenger-boats and the larger vessels of the canal trade under a variety of conditions. Some of the most remarkable results were as follow:—With a passenger-boat laden with passengers (an average load) a rate of 20 miles per hour was attained, and it was evident that the only limit to the speed was that of the power of the engine.

Eight trading vessels were ranged in a line, attached to each other, and the first to the locomotive. The total tons register was 317; actual load in tons, 364; and their draught of water varying from 4 ft. 6 in. to 8 ft. 10 in. For the haulage of this amount of tonnage, at the usual rate of 1½ miles per

hour, about 20 horses are employed, under the most favourable circumstances. The Victoria towed it, with about one-fourth only of her steam power, at a rate of 2¼ miles per hour. The ease with which she did this, justified the opinion of several spectators, qualified to judge, that double this amount of tonnage might have been mastered by her with very little, if any, diminution of her speed. The wave produced by the motion of the large vessels at the rate they were towed, was of the ordinary size and character; that of the rapid boats, though large, was by no means so formidable as to create any fear that it would be any obstacle to the adoption of this mode of conveyance. In one of the latter experiments, four passenger-boats were towed in a line, and the volume of the waves was evidently broken up into numberless smaller waves, spreading over the whole surface of the canal, and resembling a great ripple. The reverse of this occurred when two passenger-boats were lashed together abreast, as a twin boat; the wave then extended in a fine regular glassy swell from the boats to the shores. These effects point out the fact, that the form, magnitude, position, &c., of the wave, are all susceptible of modification, as little is to be apprehended from curves, of whatever character. In the railway upon which the engine travelled, there was a curve of double flexure, the radius of part of which was less than a third of a mile. No sensible retardation in her speed was produced by it, nor was any disposition observed, even in the most rapid transits, to run off the rails. To prevent the latter effect occurring from the resistance of the vessels towed, the outer rail was laid a little lower in level than the inner one, so as to give the engine a slight tendency to descend towards the outward rail. This also prevents, in a certain degree, the overturning of the engine by a strong pull.

PATENTING OF M. DAGUERRE'S PROCESS IN ENGLAND.

It has excited some surprise that, after the eager and natural curiosity of the public respecting the discovery of M. Daguerre while it yet remained a secret, so little interest should now be taken in the subject. The truth is, that the public were led to believe that the process was so extremely simple, that once known it could be practised without difficulty—so simple, indeed, that M. Daguerre could not be protected by patent rights, and therefore the French government consented to grant him an annuity. Whereas, without meaning *in any* way to *undervalue the discovery or its important* consequences, it now turns out that the process is very delicate and complicated, requiring great skill and care in the manipulator; and so easily can M. Daguerre protect his interests, that he has had a patent taken out in England in the name of Mr. Miles Berry, of Chancery-lane, not only for the manufacture of the Daguerreotype, but *for the use of the instrument*. How far such a proceeding was contemplated by the French government—how far it can be justified by the letter of the agreement—how far such a patent can, under the circumstances, be maintained, we must leave others to determine; we merely state as a fact what has been much and generally disbelieved. Persons, indeed, to whom M. Daguerre was known, and who had read the trumpetings in the foreign journals of the liberality of the French government in making this discovery public for the benefit of the civilized world, could not be persuaded that he was a party to such a proceeding, and therefore addressed a letter to him on the subject; but his answer, which we now publish, is conclusive:—

"18th Oct. 1839.

"Sir,—In answer to your letter of the 4th instant, respecting the process of the Daguerreotype and the patent obtained in England for the same in the name of Mr. Miles Berry, Chancery-lane, previous to any exhibition thereof in France, I beg to state that *it is with my full concurrence that the patent has been so obtained*, and that Mr. Miles Berry has full authority to act as he thinks fit under proper legal advice.

"I would add that if you will take the trouble to read attentively the articles of the agreement between me and the French government, you will see that the process has been sold, not to the civilized world, but to the government of France for the benefit of my fellow countrymen.

"I thank you for your good wishes and flattering letter, and with esteem for your high talent as an artist, and desire to have good-will and assistance in England as well as in France, I remain, Sir, your obedient servant, (Signed) "DAGUERRE."

It is a curious fact, and further illustrative of this extraordinary proceeding, that Daguerreotypes, which cost from 20*l*. to 25*l*., have been sent direct to this country by manufacturers who profess to pay a commission to M. Daguerre himself; and yet, though so sold and sent by his own agents, and to his own profit, the parties purchasing must not *even use them* if these patent rights can be sustained. Mr. Cooper, indeed, at the Polytechnic Institution, has thought it advisable to protect himself by obtaining the sanction of the patenee, by

whom Mr. St. Croix, at the Adelaide Gallery, was for a time stopped; though, under advice, he has now resumed his exhibition. —*Athenæum.*

ATTEMPT TO STEER A BALLOON AGAINST THE WIND.

For some time past a workman named Eulriot has been making experiments in Paris to steer balloons, and he has long announced that his first essay would take place on Sunday the 20th ult., at the Champ-de-Mars. Many Parisian sceptics contended that his ascent would be confined to a monetary *vol*, and not an aerial one; but the promise to return the money in the event of the experiment not succeeding, at length excited the attention and curiosity of the public to a very great height. On approaching the Champ-de-Mars there were thousands of spectators at the exterior, but their ardour was damped at the entrance gate by the demand of twenty francs admission into the interior of the circle, where the balloon was filling, and five francs for the second places. The consequence was that the civil and military force considerably preponderated, for there was a battalion of light infantry, one of the line, a squadron of municipal cavalry, two commissaries of police, besides a host of police agents and *sergens de ville*, &c. One extraordinary preparation must not be omitted in this account. It was a litter covered with a mattress, in case Mr. Eulriot should tumble out on the Champ-de-Mars. Three o'clock was the hour announced for the ascent, at which period I arrived on the ground, and found a huge unwieldy machine, in the shape of what the Frenchmen called an immense *ovoide*, lying on its sides; but I thought the description of Prince Lichnowski, who was on the ground, the most graphic. He termed it a colossal German sausage with a net thrown over it. The car was, of course, the greatest novelty, as it was the means by which the huge machine was to be navigated. It consisted of a kind of chair or cabriolet seat, but without the wheels, in lieu of which were appended on each side, sails like those of windmills. Before and behind the car or chair were two machines like ships' poops. The secret of M. Eulriot was, that these flaps, paddles, or windmill sails, would act against the currents. What struck me instantly as highly dangerous was the descent, as the car, on touching the earth, must be broken to pieces, and its occupant thrown rudely out. I communicated my fears to the *veteran Garnerin, who was,* with his *aeronautic daughter, rendering every assistance* to the new aspirant for clouded honours. M. Garnerin shrugged his shoulders, and did not seem at all to admire the contrivance, but M. Eulriot was confident, and all was got ready to start. The netting was attached to the hoop in the usual manner, and at half-past four the ascending power was tested. The balloon was paraded over the heads of the spectators, M. Eulriot, without coat or hat, working hastily at his windlass. It rose, however, but a few feet, and would have touched some palings had it not been pushed off, and M. Garnerin called out to him to throw out ballast, which he did. The balloon then rose rapidly, and, as had been foreseen, in despite of the sails took the exact direction of the pilot balloon, which had been let off previously by Mdlle. Garnerin. Yet everything was in favour of the experiment; there was no sun, and scarcely a breath of wind; but it was evident the balloon dragged away the car, and not the car the balloon, as was expected by M. Eulriot. The strength of the mechanism was not sufficient to cope with the huge body propelled by the ascending power of the gas. Within five minutes, owing to a thick mist which prevailed, the balloon was out of sight, leaving the multitude below to descant learnedly upon the causes of the failure, and to discuss whether the admission money ought not to be reclaimed.—*Times.*

ROBERTS'S MODE OF RESHIPPING A RUDDER AT SEA.

[Communicated to the Society of Arts for Scotland, and published in the Edinb. New Phil. Journal, No. 53.]

Amongst the "dangers of the sea" a frequent and a most fearful accident is, the loss of the ship's rudder; when this occurs, she lies a helpless log at the mercy of the waves, liable to broach to, and be thrown on her beam ends, or have everything washed off her deck.

The loss of the rudder is an accident of which every seaman has a great dread, and if any method can be pointed out whereby he can in a few minutes remedy this misfortune, he will, I am sure, hail it as a great boon.

The apparatus necessary for this purpose is simple, and is also cheap, an advantage that will have great weight with ship-owners.

Before the ship leaves her dock, a hole must be bored in the heel of the stern post, of sufficient size to allow of two small ropes being rove through it; these ropes I would recommend should be of wire, such as I have used in my ship's lightning conductors; they

are made of copper wires laid up as a common hemp rope, are very flexible, can be rove through a small sheave, and possess great strength in a small compass. Let two ropes be rove through the hole in the heel of the stern post, and both parts of each rope be brought in board through the rudder case; being of a small size, they will offer but little obstruction to the ship's progress, or to prevent them from doing so in the slightest degree, a groove may be made in the sides of the stern post for the ropes to lie in. These ropes must, of course, be rove before the ship leaves the harbour, and at sea they must be overhauled or worked backwards and forwards occasionally (say once a-week) to keep all clear for running, should an accident to the rudder require their use.

Let us now suppose the ship's rudder to be carried away. In general the rudder is only unshipped, and can be recovered by means of the rudder chains; when this is the case bring the rudder upon deck. But if the rudder is totally lost, make use of a spare one, which can be easily carried in separate pieces; or in default of this, rig up a rudder of spars and ropes on Captain Pakenham's, or on any other easier plan. Having your rudder upon deck, let a hole be bored through the heel, and in such a part as will correspond with the hole in the stern post when the rudder is in its proper position. Through the hole in the rudder work a grommet, either of rope or wire, but very strong, for this grommet must traverse freely in the hole. Now bring in over the quarter an end of each rope, rove through the stern post, and make both fast to the grommet in the heel of the rudder. Then drop a guy rope through the rudder case, and bring the end in over the quarter, and make it fast to the head of the rudder. All is now prepared. Heave your rudder overboard, haul upon the guy made fast to the rudder-head (this will lead it to the rudder-case), and rouse in the slack of the rudder-heel-ropes. Bring the rudder-head up the rudder-case, and, when high enough, haul taut and belay your heel-ropes. The rudder-head guy-rope, which should be a strong one, may be now made fast to a spar going across the deck, or a frame-work may be made above the rudder-head, to which the head-rope may be fixed; this is to support the weight of the rudder, and thus take off the strain from the heel-ropes. But in a two-decked ship, as in a ship of war, the head-rope may be fixed to a carline between the beams of the deck, immediately above the rudder-head. Every thing is now in its place, and the rudder is quite as secure, if not more so, than when the ship left her port.

The *great objection to all plans before* suggested for reshipping a rudder is the difficulty of keeping the heel of the rudder down; this arises from several causes, viz., its own buoyancy, the ship's forward motion, and the action of the waves. All these causes combine to throw up the heel of the rudder, render it useless in steering the ship, and tear away the cumbrous apparatus of guys, &c., usually led under the bottom of the ship with the intention of keeping the heel of the rudder down. But by the method I have now suggested, the rudder will be maintained in a good position, and in perfect security.

My plan is, as I have before said, cheap and simple, and it will give me heartfelt satisfaction if this suggestion is ever found useful in a time of need.

MARTYN J. ROBERTS.

LIST OF IRISH PATENTS GRANTED IN SEPTEMBER, 1839.

John Menar, for certain improved processes to be used in the printing, dying, or colouring of cotton, woollen, silk, or other cloths and yarns. Sept. 10.

Peter Lomax, for certain improvements in looms for weaving. September 3.

Job Cutler, for improvements in combinations of metals applicable to the making of tubes or pipes, and to other purposes, and in the method or methods of making tubes or pipes therefrom; which improved method or methods is, or are applicable to the making of tubes or pipes from certain other metals or combination of metals. September 4.

G. H. Palmer, for certain improvements in paddle-wheels for propelling ships' boats, or other vessels navigated by steam or other power. Sept. 4.

C. A. Caldwell, for improvements in furnaces and apparatus for applying the heat of fuel. Sept. 19.

Richard Beard, for improvements in printing calicoes and other fabrics. September 19.

NOTES AND NOTICES.

Artificial Granite Road.—A short time since a new pathway was laid down in that part of Bird Cage-walk near Storey's-gate. The material composing the pathway is a new invention, styled—"artificial granite," and a "mineral, animal, and vegetable combination." The process adopted in laying it down is similar to that of the asphalte, the composition being poured out boiling hot upon the loose gravel, with which it amalgamates. A few minutes suffice to make the composition quite cold, and as hard as the hardest stone. The appearance of that part of the pathway already finished is that of a finely polished and black block of marble. It is said to be impervious to wet, will not be affected by the sun like the asphalte, and its durability is even greater than marble itself, which has been proved from the fact that a rough piece of marble or granite can be rubbed perfectly smooth on a block of this composition without apparently wearing the latter. Its hardness may be judged from the following test:—a block about five feet by three, and two inches in thickness, was struck for several minutes with heavy sledge hammers by the workmen, and it failed to break; whereas marble, granite, or any other stone, would have flown to pieces. This composition is the invention of M. d'Harcourt, a French gentleman, who is laying down the above-mentioned pathway by order of the Commissioners of Woods and Forests, who intend, should the experiment succeed, to have the whole length of Bird

cage-walk done in a similar manner, as also the Parade in front of the new palace.—*Engineers' and Surveyors' Magazine.*

Whitelaw's Hydraulic Engine.—The advantages of this machine are said to be very great. In the first place, while, by the common water-wheel, in some circumstances, only a small portion of the water-power can be used, and under the most favourable circumstances not more than sixty-five per cent., it is calculated that, by this new machine, not less than ninety-five per cent. of the motive of the water is rendered available. Secondly, the most trifling rivulet, provided it have a good fall, can be taken advantage of by the new machine; and, thirdly, the expense of the improved Barker mill is not more than one-fifth of the expense of a water-wheel, to work in the same stream. We are informed that one of the new machines was to be put up on the Shaws Water, near Greenock, for about £300, to do the work of a water-wheel which would have cost, according to estimate, £1500. That these advantages are not imaginary, we are satisfied, first, from having seen one of the machines at work; and, secondly, from finding that the able author of the article on Hydrodynamics, in the new edition of the Encyclopædia Britannica, gives his opinion in favour of the principle of re-action—"Though it has not yet," he says, "been adopted in practice, it appears from theory and from some detached experiments on a small scale, that a given quantity of water, falling through a given height, will produce greater effects by its re-action than by its impulse or its weight." Mr. Whitelaw's patent, so far as we are able to judge, has removed all obstacles to the full application of the principle. We have noticed this machine thus prominently, on account of the high opinion we entertain of its excellence, and because we have reason to believe that it will be found exceedingly useful to many of our readers. There are few of our country millers that have not often occasion to complain of a deficiency of water. A saving of thirty per cent. will be to them of great importance. Then there are in various places small streamlets that cannot be taken advantage of by the water-wheel, but which, by the new machine, might be turned to great account in driving both mills and thrashing-machines.—*Aberdeen Herald.*

Another Photogenic Process.—A new method of producing photogenic drawings was yesterday exhibited to a small circle of scientific persons. The drawings produced, which combine the minute exactness detailed in Daguerre's tables with the powerful contrast of the light and shadow of an original drawing, are effected by means of Indian ink. By this new process the plate on which the light is to act is placed in the camera obscura entirely black, and the action of the light upon it destroys either partially or entirely the blackened surface, thus producing the various tints of a drawing from the most perfect white, through all the different degrees of shadow, to a jet black. The blackened plate is so sensibly affected by the rays of light, that objects illuminated only by the faint light of a common candle are depicted in all their detail as distinctly as if acted on by the brightest sunlight. Whilst putting the plates into the camera obscura the operator must only make use of a small lantern with a coloured glass, in an otherwise perfectly darkened room, and the same precaution must be taken in fixing the images produced in the camera obscura. Unfortunately the preparation of these new photogenic plates is rather complicated, requiring the science of a chymist as well as the skilful hand of an artist, and the inventor (Dr. Schafhaeutl, of Munich) has not yet correctly ascertained how long these plates will remain sensible to the action of light. The Doctor hopes, however, that they may be kept in that state for years, and there is nothing to prevent a most extensive use of this new method, as the process of generating and fixing these wonderful images is very short and simple. The inventor promises, as soon as he has simplified the mode of preparing the plates for this new method, to make it public through the medium of one of our scientific journals.

The "Archimedes" Screw Steamer.—This vessel having been fitted with new boilers in place of those which burst some time ago, has lately resumed her experimental trips. From the various accounts of these trials which we have seen, it would appear that her average speed has been about eight miles an hour, with between 22 and 23 strokes per minute of the engine, each stroke producing 5⅓rd revolutions of the screw, which is 5 ft. in diameter. The *Archimedes* had her three masts and rigging standing. The tremulous motion of the vessel, and the noise of the working of the cog wheels was very considerable. The pressure of the steam, and the sizes of the engines does not appear.

College for Civil Engineers.—The new school for instruction in civil engineering, now so important a profession, and becoming almost daily more so from the great and extensive national and public undertakings now in progress, is going on very favourably. The directors have taken Gordon-house, near Hampstead, a large establishment, which is fitting up for the reception of the college, which it is expected will be in active operation early in the spring. The Duke of Buccleuch, the president, has given a donation of 1,000*l.* towards its objects, and many presents have already been made to the library, and also models of machinery and specimens for the museum. The candidates for the appointments of professorships are numerous, including many of the first-rate talent, although few have been yet decided on.

Dye-Wood.—A method of extracting the colouring matter from wood has been lately employed by a M. Besseyre with much success. He first reduces the woods to very small divisions, and then immediately places them in a closed vessel exposed to a current of steam. When the whole has attained 80 degrees of heat, it is uncovered, and watered with several pints of cold water. By means of a tap below, the condensed liquid is drawn off, and thrown back upon the chips, and this operation is repeated until the dye has acquired sufficient strength; it is then subjected to evaporation over an open fire, and subsequently in a sand bath, and the extract becomes a mass, which is soluble in warm water.—*Athenæum.*

Non-Adhesive Caoutchouc—In the Report of the Committee on the late exhibition of Domestic Manufactures, held at the Frank. Inst., Philadel., it is observed "these articles (gum elastic goods) manufactured at Roxbury near Boston, recommend themselves strongly to favourable notice. They consist of gum elastic attenuated into thin sheets, and these sheets, in some specimens, cemented apparently by simple pressure to the printed surface of calicoes, chintzes, engravings, maps, &c. and in others made themselves the ground upon which various coloured patterns are imprinted. The peculiar merit of these goods is their retaining, in a perfect degree, all the original qualities of the gum elastic; its elasticity, its toughness, freedom from odour, and absence of all adhesiveness; the latter feature giving to this manufacture a decided superiority over any other preparation of the gum hitherto attempted. The attention of the Committee was particularly attracted to the beauty and evenness of texture of a shawl, consisting wholly of the gum elastic, upon which a very tasteful pattern has been impressed.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 848.] SATURDAY, NOVEMBER 9, 1839. [Price 3*d*.

Printed and Published for the Proprietor, by W. A. Robertson, No. 166, Fleet-street.

ECONOMICAL WARMING AND COOKING STOVES.

Fig. 1.

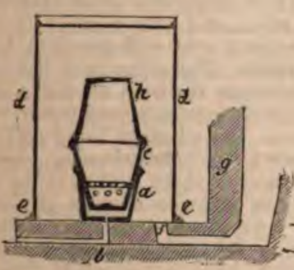


Fig. 2.

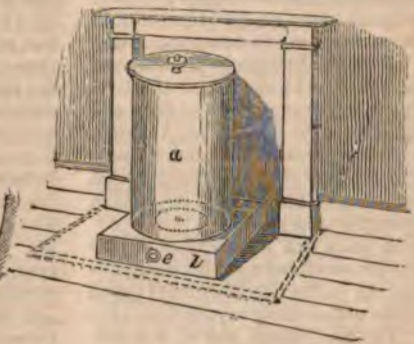


Fig. 3

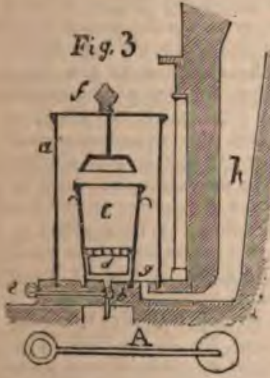


Fig. 4.

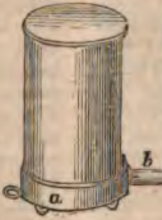


Fig. 6

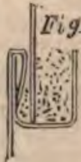


Fig. 5.

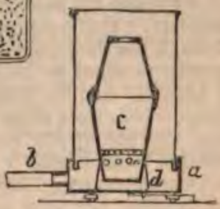


Fig. 7.

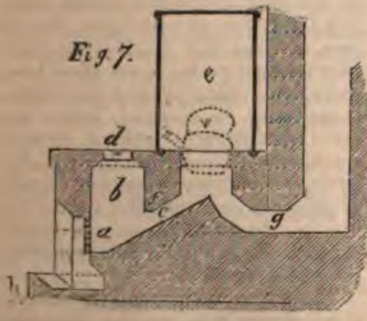


Fig. 8.

SIMPLE AND ECONOMICAL STOVES FOR WARMING AND COOKING.

Sir,—During last winter, in some parts of the country, Arnott's stoves were in such requisition, that it was a difficult matter to procure one in any reasonable time after an order was given; and as the time of the year is again fast approaching when artificial heat is needful, I have thought that it might be of advantage to some of your many readers to exhibit in your pages some modes of warming that I have adopted at different periods, and which in practice I have found effective, with a very moderate supply of fuel, and much cheaper at first cost than Arnott's, or any other stoves that I have seen. They are likewise of such a construction that any country blacksmith or tinman may make the iron work.

Several years ago the locality of my employment was three miles from my residence, and in such a situation, that I found it requisite occasionally myself to cook a meal. The fire I made use of was produced from wood, burned in a garden pot, having a small iron grating resting on the inclined sides about three inches from the bottom, the hole being plugged up with clay. Half a dozen holes were cut through the sides immediately under the grating to admit air to the fire. The space between and the bottom received the ashes, which were easily emptied by turning the pot upside down. When the weather became cold I turned this into a close stove, by setting the furnace pot into another not quite so inclined in the sides, and an old sheet-iron cement cask. This arrangement is shown in fig. 1. *a* is a pot cemented with plaster to a stone slate, having a hole *b* corresponding with that of the pot, to admit air to supply the furnace pot *c*. *d d* is the iron cask turned mouth downwards over the furnace, having a little sand strewed around the mouth at *e*, to retain the hot air in the cylinder. At *f* is an opening in the stone to conduct the heated gases, &c., to the upright flue *g*. When I wanted to heat my small office longer than twelve hours, I inverted a pot *h* over the furnace, and filled it up with fuel through the hole in the bottom, which was enlarged to about two and a half inches diameter. When fully charged with coke it would give off sufficient heat for twenty-four hours.

At present I have the stove in use represented at fig. 2. The iron cylinder *a* rests in a groove cut in the stone base *b*, having a little sand to make an air-tight joint. The furnace *c*, fig. 3, made of sheet iron, rests in a similar groove filled with sand. The ash-pan *d* is of sheet iron, made about an inch less in diameter than the furnace cylinder, to admit air through the holes under the grating that supports the fuel. The air enters by a hole in the floor at the other end of the room, and passes under the floor, thus doing away with any draft toward the stove. The stone base has a hole drilled from the front to admit a strong wire having the outer end turned into a ring *e*. The other end being split to receive a piece of sheet iron cut exactly to the diameter of the air-hole in the stone. The ring and the circular plate are on the same plane, so that by turning the ring to any angle, the opening of the circular valve is indicated. The wire and plate are shown larger, below at A. Over the furnace is the pan of a garden pot suspended from the top; this is to prevent the radiation of the fire from over-heating the top of the cylinder *a*. The knob *f* is partly of wood, to be used to lift the cylinder, should it be necessary to supply fuel during any part of the day while the stove is hot. The passage *g* leading to the flue *h* is cut in the stone. Where stone is not convenient a sheet iron base might be made (as at *a*, fig. 4 and 5), having a sand channel formed, as shown at fig. 6, and with a small iron pipe to convey the heated gases, &c., to the flue. The furnace *c* might be made of cast iron, cast with a small projection for the grating to rest upon, and with a similar one outside for a stop to rest upon the fixed ring of sheet iron *a*. If a continuous heat for twenty-four hours should be required, a garden pot with the hole enlarged may be inverted, which would assist materially in keeping up a clear combustion of the fuel. The pot should be hooped with iron to prevent its falling to pieces in case the heat should crack it. A stove of this description could be made to sell at a profit at half the lowest price of Arnott's stove.

Those who understand the nature of close stoves will see the propriety of using coke, house cinders, anthracite coal, or charcoal; for, where coal is used

with a descending flue, the carbonaceous matter attaching itself to the inner surface of the higher part, and being a bad conductor of heat, intercepts it from the iron, and instead of its being conducted through to the room, it is conveyed up the flue. There is also, when common coal is used, a danger of explosion from the accumulation of hydrogen in the upper part of the stove, arising from the want of a sufficient supply of air during the decomposition of the coal. To obviate these defects arising from the consumption of common coal in close stoves, about ten years ago I constructed a stove chiefly of brick, represented in fig. 7 and 8. Fig. 7 is a longitudinal section through the centre; *a* is an iron grating in front to admit air to the fuel which fills the space *b*, the opening *d* being closely stopped by a stone accurately fitted. When the fuel is lighted, the air entering the grating *a* passes through the fuel to the opening *c*, keeping up an intense combustion, so that the gases and carbon generated from the coal in the space *b*, meeting with a current of air from the sides entering just above the opening *c* at *f*, thereby a complete decomposition of the smoke is caused. The hot air and flame passing along *c* will keep a continual circulation in the cylinder *e*, forming as complete a close stove as could be desired. *g* is the opening to convey a portion of hot air to keep up the draft. The fender *h* is of stone hollowed out to retain the ashes. It is obvious that this stove may be used either as a roasting, boiling, or heating apparatus. It is adapted for roasting with the greatest cleanliness, arising from a constant current of air passing to the grating *a*, which prevents the ashes from flying about; and for boiling, the dotted kettle shows how the heat is applied for that purpose. As some ashes will accumulate at *g*, a half brick *i* should be neatly fitted in the side to permit of clearing out any accumulation.

In all stoves where coke is used the heat should never be allowed to sink below 220 or 30 degrees, the quantity of carbonic oxide generated being so great, that below that heat the oxide will not be carried off, but descend into the room. This may have been observed by many, when a common coal fire has been suffered *to fall low, the quantity of carbonic oxide is given so plentifully*, that a portion of necessity descends, there not being a sufficiency of caloric generated to render the whole volatile; so one portion ascends the flue, the other descends to the apartment.

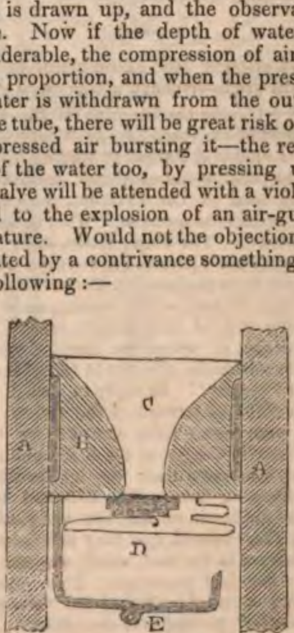
As soon as I have a little leisure to reduce some drawings of a heating and cooking stove adapted to small cottages, to the limits of your pages, I will forward them for your insertion.

I remain respectfully, &c.

J. + J.

SUB-MARINE REGISTER OF SOUNDINGS.

Sir,—In No. 836 of your Magazine, p. 369, there is described a sub-marine instrument; in several respects it is well adapted to its object, but is, I think, liable to one or two serious objections. On reference to the sketch, your readers will observe, that the compressed air is proposed to be retained in the tube until the instrument is drawn up, and the observation made. Now if the depth of water be considerable, the compression of air will be in proportion, and when the pressure of water is withdrawn from the outside of the tube, there will be great risk of the compressed air bursting it—the releasing of the water too, by pressing upon the valve will be attended with a violence equal to the explosion of an air-gun in miniature. Would not the objections be obviated by a contrivance something like the following:—



A A, section of glass tube or cylinder; B, a plug of wood or ivory, or other suitable material, packed so as to slide pretty easily up and down the tube, and perforated with the funnel shaped aperture C.

D, a flat valve opening downwards, closing the bottom of the aperture, and just kept closed, by a light wire spring. On sinking the machine, the water will press against the bottom of the plug and move it upwards, compressing the air in the tube. On raising the instrument, the compressed air will expand through the aperture C and valve D; without moving the plug downwards again, and the upper margin of the plug will indicate the measure of the compression of the air. A scale may be engraved on the tube, or affixed to it, at the pleasure of the maker.

E is a wire by which the plug may be drawn down to zero preparatory to using the instrument. The other details will of course suggest themselves to any machinist who should desire to construct such a "sub-marine register of soundings."

I remain, Sir, yours, &c.

F. R.

Canterbury, Oct. 4, 1839.

ROYAL SOCIETY FOR PROTECTION OF LIFE FROM FIRE—WIVELL'S WATER CARTS.

Sir,—Having the honor to be the superintendent of the above Society, it becomes my duty to answer a statement tending to hold it up to ridicule and contempt, published in your journal of the 19th ult., page 48, to which article the name of "Wm. Baddeley" is attached. The writer states, that, "Mr. Merryweather's portable fire-escape ladders had only been stationed in the parish (of St. Clements Danes) a few weeks, when they were the blessed instruments, under Divine Providence, of saving the lives of nearly a dozen individuals, at a fire in the Strand, on the 3rd instant." In reply to this, I must give a different account of the matter. The lives were saved from that fire by R. T. Lock and T. Carter, of the F division of the police, who made their way up the stairs of the adjoining house, No. 273, and to the roof of the house on fire, into the window of which they entered, and they there assisted the lodgers to the roof, which was the only means they had to escape. This communication was complete before the "*blessed instruments," the ladders, were raised.*

Mr. Baddeley further states, that "attention to this subject on the part of the London parishes, is more needful than ever, since *the failure* and breaking up of that precious *piece of humbug, the Fire-escape Society." To this I answer, there have been some differences of opinion in the Committee,* relative to the best plan to be adopted, since the last annual meeting of the subscribers. Upon a strict examination of their accounts, they deemed it expedient, in consequence of *deficiency of funds*, to dispense with the services of some of their fire-escape conductors, until they should be provided with machines constructed on a new principle, to accompany their established escapes, as a further security for the lives of the public.

The reason why Mr. Baddeley is constantly endeavouring to thwart the views of this Society can only be known to himself, for, to my certain knowledge, through the whole of his correspondence with the Society, he has been most respectfully and promptly answered. * * *

The remainder of this letter I shall reserve for the good of the public, by describing a *new plan* for the better protection of life from fire.

On the 10th of September I submitted the plan referred to, to the Royal Society for the Protection of Life from Fire, and the Committee so much approved of them, as to order them to be put into immediate operation.

It is an indisputable fact that the means hitherto provided against accidental fire, have not kept pace with other recent improvements adopted throughout the metropolis. In respect to the proper mode of procuring efficient means for this object, namely, *funds*, there are various opinions; the most predominant of which is, that they ought to emanate from the national treasury. Some imagine that the responsibility should be invested in the *Insurance Companies*, while others affirm the fairest way would be to levy a rate upon *Housekeepers*. However, the churchwardens alone are bound, by an act of parliament, to cause fire-engines and fire-ladders to be kept in each of their respective parishes; but there is no compulsion to provide experienced men to superintend the use of the ladders and engines, in a case of necessity. Each housekeeper, however, whose chimney may be found on fire, is bound by the act to pay a certain sum for the conveyance of one or more of such engines to the fire.

At New York, I am informed, fires occur in a far greater number than in London, but their escape-ladders are numerous and are equally distributed, and the number of firemen is 13,000. It is by this ample provision that a life is, notwithstanding the number of fires, seldom lost; perhaps not more than one in a year.

It is nearly four years since that melancholy event, at which several lives were lost, occurred in Tottenham-court-road. The inhabitants afterwards bountifully subscribed a

sufficient sum to provide a new fire-engine and fire-escapes, which were placed in the neighbourhood. Notwithstanding these precautions several fires have since taken place within a few paces of the machines, without their having been moved in time to be of service in either case; owing to the want of men being appointed for that purpose by proper authorities, such as are constituted in the present society.

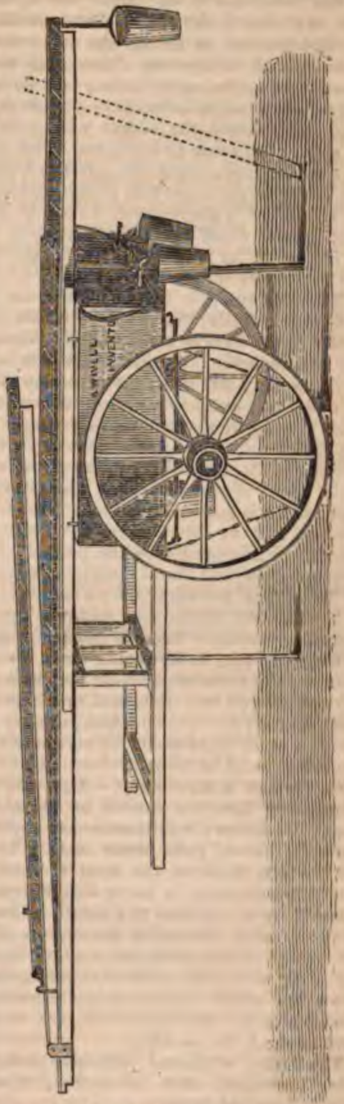
With respect to fire-engines belonging to the Insurance Companies, it is true that they have at all times been prepared to start at a short notice, and have proceeded at a rapid pace, let the fire be ever so near or distant; but, unfortunately, in all the distant cases we only hear of them arriving on the spot too late. But it is hoped that this will be altered shortly, and that the environs of London will be supplied with efficient apparatus according to the new system, which is here copied from the Society's prospectus:—

"In consequence of the very alarming extent of fires within the last few years, attended with a dreadful sacrifice of life, the 'Royal Society for the Protection of Life from Fire,' are endeavouring to mature a plan, in the hope of putting a stop to so severe a calamity. In carrying out their intentions, it must be distinctly understood that they can only do so by the inhabitants of each respective district uniting as a body to give them their support. The plan is simple and efficient; the means required—though large in the aggregate—are exceedingly trifling were each householder to contribute a small sum annually, by which means the inhabitants may at all times rely upon the *instant* attendance of the apparatus belonging to the Society, with men practically experienced in its use.

"During the years 1838 and 1839 there have occurred, in and about the metropolis, upwards of 1000 fires, at nearly 300 of which the machines of the Society have attended, and rendered important service. In consequence, however, of the Society not having met with the encouragement it deserved, its funds have lately become so completely exhausted as to prevent the Committee carrying out, to the extent they could wish, the object for which the Society was formed.

"The new plan proposed to be adopted is, to place in each district (London being divided into sixty-nine) small carts with water, in addition to the life-escapes, which are to be at all times in readiness, so that at a moment's notice they may proceed to the spot, and be brought into immediate use. It is a fact well known, that the want of a few buckets of water at the *commencement* of a fire, has frequently *caused the destruction of property to an incredible amount.*

"The Committee therefore earnestly entreat householders and lodgers to subscribe,



and enable the Society to accomplish this most important and laudable undertaking."*

* On the north side of the Thames are included Paddington, Portland-town, Camden-town, Somer's-town, Pentonville, Islington, Hoxton, Bethnal-green, Globe-town, Stepney, Limehouse, and Poplar. At the west end are, Brompton, Pimlico, and Chelsea. On the south are, Lambeth, Southwark, Kennington, Newington, Walworth, Bermondsey, Rotherhithe, Deptford, and Greenwich.

The length of the water-cart and shafts together, is 10 feet 6 inches, its width 4 feet. In the front, and at the back part of the cart, are bolts, which are applied according to circumstances, in having the cart raised at either end, or lowered. These bolts also prevent the ladders upon the cart from sliding either backwards or forwards in its conveyance; and, should the ladders when raised be required to reach an additional 4 feet, the cart can be drawn upon the pavement, and the ladder be put upon it in perfect security, on account of a groove upon the top of the cart, against which the ladder stands, as to be impossible for it to slide. In this groove the ladders are seen in the sketch.

The main ladder is in two parts; one 18 feet long, and the other 11 feet, which are united in the form of a clasp knife. On the two lengths being formed into one they are made fast by a pair of iron clips, which slide on or off very quick at pleasure. This ladder when raised extends from the kirb stone to the sill of the second-floor window, in the position of the dotted lines in the engraving, under which is seen suspended a bucket to a rope, which is fastened to a spoke nearly at the top, and in this manner the water is raised and conveyed into the parlour, the drawing-room, and floors above, at the rate of 20 gallons per minute, by a man who is to be stationed for the time upon the upper part of the ladder. There is another ladder, in length 15 feet, to be used in areas, and to rooms of the same height. At the back of the cart are two taps the handles of which meet, and are fastened by a lock, the key of which is at all times about the person of the conductor, until he is upon duty at night, when the lock is taken away. The water is set running into two buckets at the same time. Whenever circumstances may require the assistance of these water carts I have not the least doubt of the most favourable result, particularly in narrow courts, and where there are gardens in front of houses; for the prompt conveyance of the apparatus, the facility of its application, and the disposing of the water over the flooring, and up and down the stairs, and in every direction, shortly after the discovery of the fire, must tend to check its spreading.

The design originated with me, through being impressed with the truth of Shakspere's beautiful lines—

"A little fire is quickly trodden out,
Which being suffered rivers cannot quench."

I am, Sir, your most obedient servant,

A. Wivell.*

Charlotte-street, Bloomsbury,
Oct. 31, 1839.

* *See note appended to the next communication.*—*Ed. M. M.*

NEW APPARATUS FOR THE EXTINCTION OF FIRE — THE EX-FIRE-ESCAPE SOCIETY AGAIN.

Sir,—From a paragraph which has been going the round of the newspapers, we learn that Mr. Wivell *umquhile* superintendant of the ex-Fire-Escape Society, has lately been making an exhibition, (by the way exhibitions are decidedly his forte) of a new apparatus—not for saving lives, fruitless task! but for extinguishing fires. "His *object*," (query his *plan*) "is the division of London into districts, each to be furnished with a fire-escape, or water cart, and also a fire-ladder." The arrangements for carrying up the water to any part of the building are said to be—"very *simple*." We are told that "twenty gallons of water per minute can be discharged:" but the most extraordinary discovery connected with this amphibious apparatus is, that it has been "proved to be applicable to courts and other narrow entries, where the common fire-engine could not be introduced!" It is very singular that our sapient Superintendant should not by this time have *heard* of the invaluable invention of *leather hose*, which enables a person to introduce the most powerful engine, *i. e.*, the jet of water, not only into "courts and narrow entries," but actually up stairs, into rooms, roofs and cupboards, indeed into every place where man can enter, and sometimes into places where he cannot go. From the seemingly intentional ambiguity of the published description, it is not easy to say whose plan Mr. Wivell has upon this occasion endeavoured to resuscitate. If it is that of Mr. Michael Rough (published at page 155 of your 10th volume) the "murder will soon out" for Mr. Rough is on the alert. He waited upon the committee of the defunct society last week, but could not obtain an audience, the excuse being, that the committee were engaged in digesting Mr. Baddeley's letter in the 845th No. of the *Mechanics' Magazine!* Should the "new apparatus" prove to be the admirable invention (the fire-cart) of the humane and ingenious Captain Manby, fully described in your 3d volume, page 28, the gallant Captain having been a V.P. of the society, will of course take care of his own. If it is not *this*, it is most assuredly something *inferior to it*.

The paragraph to which I have alluded, ends with the following doleful announcement; —"The Society not having met with the encouragement it deserved, its funds are now completely exhausted"—and the writer might have added—besides being in debt to the tune of about 700*l.*! If the writer's modesty would permit, I should like to know what amount of encouragement he considers the

society to have *deserved?* When I state that last year, subscriptions amounted to very near 2000*l*., the *deserts* of the Society become a very interesting question. Had the excellent "*specific objects of the Society*," as enumerated in their prospectuses, been in any degree realised, quite enough has been done to prove that there would have been no lack of *encouragement*. But with a handsome income like that I have just mentioned, and no *beneficial results*, it is not to be wondered at that the public eyes are opened. A writer in your 826th number says, "It is a great pity, that a society for such an excellent purpose, *which has been so nobly patronised, and so liberally supported* should suffer from incompetence or want of respectability on the part of its officials."

* * * * *

There is an ample field for a society of this kind in our metropolis, which, if well conducted, would prove an inestimable benefit, and reflect the highest honour on every person connected with it. But the protection of the public must be its object; and positive utility, not empty parade, its aim. The long list of high-sounding names in its prospectuses, must be those of men zealous for the prosperity of the society, and not of those who have lent their name upon the express stipulation that nothing but their names shall be required of them!

I remain, Sir, yours respectfully,

Wm. Baddeley.*

Nov. 1, 1839.

THE "ROYAL GEORGE"—SUBMARINE ILLUMINATION.

"——— Waters dark and deep,
Won from the void and formless infinite."
Milton's Paradise Lost.

Sir,—Having read in the newspapers that, in consequence of the nature of the "waters dark and deep" of Spithead, the divers were unable to work effectively, although they brought down lamps when they descended.

I had long known of the darkness of this water from those ingenious and intrepid divers, the brothers Messrs. Deane, who were working some years ago on the *Royal George*, and from one of their assistants, Mr. Peter Tall.

Permit me now to throw out a practical hint on this subject—a subject on which, I believe, I am the very first who ever published an essay [*Mechanics' Magazine*, 1829.]

As the result of some experiments which I made in Paris, and at the Adelaide Gallery in London, even with a light so powerful as the "piercing ray" of the oxyhydrogen gas light, I know that even a very thin plate of muddy water cannot be artificially illuminated, so as to permit that it shall be penetrable by human vision.

But let the thickness of the plate of water interposed between the focal point of a lens concentrating the light of a brilliant lamp, or of the oxyhydrogen gas light, and of the object in the water which you want to irradiate and to view, be indefinitely diminished; and then try, no matter how muddy and murky the water, whether the part of the object under the focal point will not be more perfectly illuminated than if seen at midsummer? and glowing in the light of the meridian sun.

I throw out this matter in its most general form for the purpose of showing, that although we cannot illuminate a large space of muddy water together, it is no bad thing to possess, as a substitute, the power of brilliantly illuminating, in succession, as many points as you choose, of an object otherwise invisible in the darksome waters.

It is scarcely necessary to say that the rays of light during their entire progress must be protected from any transmission through water, from the lamp to the focus.

The focus must fall on a piece of strong and clear glass, inserted water-tight in the apparatus.

Those who have applied their attention to the construction of optical instruments, and who at the same time understand perfectly the nature of diving operations, will perceive at a glance how the principle which I have here propounded may be made available in practice.

I have had for some time among my papers materials for a far more elaborate essay on this subject than the one which I published ten years ago in the *Mechanics' Magazine*; but I now throw the matter out to scientific men in this brief form for the emergency of the operations at Portsmouth on the *Royal George*. I could easily enumerate cases in which a very common-place application of

* It is with considerable reluctance that we again allow our pages to become the medium of a controversy which partakes so much of *personality*. Having however given publicity to Mr. Baddeley's sentiments, rather strongly expressed in our 848th number, we are under the necessity of allowing Mr. Wivell to reply thereto. Mr. Baddeley's present communication, disposes by anticipation, of some of the statements of Mr. W.'s letter; and a reference to Mr. Michael Rough's plan in our tenth volume will show that the latter gentleman has the *priority* of invention as regards the plan for distribution of water carts—allowing, Mr. Wivell, also to have been likewise an original inventor—which we have no reason to doubt. We have struck out from the letters of both our correspondents, paragraphs imputing unworthy motives to each other. The dispute must rest, as far as the *Mechanics' Magazine* is concerned, after one communication more from each party—the shorter the better to our taste, and we doubt not to the tastes of most of our readers. —Ed. M. M.

pneumatical science, superadded to what I have described, creates a theoretical principle of rendering visible, and powerfully illuminated, not mere points under the focus, but even considerable and irregular surfaces; the body being utterly submerged, not merely in muddy water, but in jet-black soft mud itself, or in thick milk, or in a vessel of mercury, &c.

I have the honour to be, Sir, your most obedient humble servant,

THOMAS STEELE,
Inventor of the Communicating Diving Bell.

Nov. 2, 1839.

KENTISH'S IMPROVED TIME TABLE.

Sir,—In one of the volumes of your Magazine, I have observed a Time Table or Almanack. The enclosed I arranged many years ago, and I fancy you will find it much more simple, and very easy of reference.

W. A. KENTISH.

A TIME TABLE FOR THE PRESENT CENTURY.

Useful to Merchants, Barristers, Solicitors, and the Public generally, in referring backwards and forwards to any year from 1800 *to* 1899.

REFERENCE LETTERS.

a	*n*	*c*	*u*	*o*	*i*	*e*
			1800	1	2	3
—	4	5	6	7	—	8
9	10	11	—	12	13	14
15	—	16	17	18	19	—
20	21	22	23	—	24	25
26	27	—	28	29	30	31
—	32	33	34	35	—	36
37	38	39	—	40	41	42
43	—	44	45	46	47	—
48	49	50	51	—	52	53
54	55	—	56	57	58	59
—	60	61	62	63	—	64
65	66	67	—	68	69	70
71	—	72	73	74	75	—
76	77	78	79	—	80	81
82	83	—	84	85	86	87
—	88	89	90	91	—	92
93	94	95	—	96	97	98
99						

Days of the Month.

	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31				
Jan. Oct.......	*a*	*e*	*i*	*o*	*u*	*c*	*n*
May..........	*e*	*i*	*o*	*u*	*c*	*n*	*a*
August........	*i*	*o*	*u*	*c*	*n*	*a*	*e*
Feb. Nov. Mar.	*o*	*u*	*c*	*n*	*a*	*e*	*i*
June..........	*u*	*c*	*n*	*a*	*e*	*i*	*o*
Sept. Dec.	*c*	*n*	*a*	*e*	*i*	*o*	*u*
April, July	*n*	*a*	*e*	*i*	*o*	*u*	*c*

Find the same letter on the right of the month, which is in the *reference* line *above* the year, and over it are all the *Sundays* in the month.

For Leap Year.—Use the reference letter above the *blank*, which *precedes* the year, for January and February; and that which is *above* the *year* for the other ten months.

Example.—Find the 24th of October, 1836. The reference letter above the year 36 is *e*. Look for *e* on the right of October, and over it are all the *Sundays* in October, which are on the 2d, 9th, 16th, 23d, and 30th. The next line is, of course, all the *Mondays*, so that the 24th is on a *Monday*. The following line is all the *Tuesdays* in October, and so on.

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* Mr. Steele has favoured us with an inspection of a diagram of the plan by which he proposes his plan of submarine illumination should be carried into effect. It is extremely ingenious, and we are promised a full description for publication in our next number. The subject is of especial interest at the present moment in connection with the operations on the wreck of the *Royal George*.—Ed. M. M.

LORD BROUGHAM'S HISTORICAL ACCOUNT OF THE DISCOVERY OF THE COMPOSITION OF WATER.

[Communicated by his Lordship to M. Arago. The notes are by Mr. James Watt, and are published by Lord Brougham's desire as "a useful commentary" on his essay.—From the *Edinburgh New Phil. Journal Translation.*]

There can be no doubt whatever that the experiment of Mr. Warltire,* related in Dr. Priestley's 5th volume, gave rise to this inquiry, at least in England; Mr. Cavendish expressly refers to it, as having set him upon making his experiments.—(Phil. Trans. 1784, p. 126.) The experiment of Mr. Warltire consisted in firing by electricity a mixture of inflammable and common air in a close vessel, and two things were said to be observed; *first*, a sensible loss of weight; *second*, a dewy deposit on the sides of the vessel.

Mr. Watt, in a note to p. 332 of his paper, Phil. Trans. 1784, inadvertently states, that the dewy deposit was first observed by Mr. Cavendish; but Mr. Cavendish himself, p. 127, expressly states Mr. Warltire to have observed it, and cites Dr. Priestley's 5th volume.

Mr. Cavendish himself could find no loss of weight, and he says that Dr. Priestley had also tried the experiment, and found none.* But Mr. Cavendish found there was always a dewy deposit, without any sooty matter. The result of many trials was, that common air and inflammable air being burnt together, in the proportion of 1000 measures of the former to 423 of the latter, "about one-fifth of the common air, and nearly all the inflammable air, lose their elasticity, and *are condensed into the dew* which lines the glass." He examined the dew, and found it to be pure water. He therefore concludes, that "almost all the inflammable air, and about one-sixth of the common air, are turned into pure water."

Mr. Cavendish then burned in the same way dephlogisticated and inflammable airs (oxygen and hydrogen gases), and the deposit was always more or less acidulous, accordingly as the air burnt with the inflammable air was more or less phlogisticated. The acid was found to be nitrous. Mr. Cavendish states, that "almost the whole of the inflammable and dephlogisticated air *is converted into pure water.*" And, again, that "if these airs could be obtained perfectly pure, the whole would be condensed." And he accounts for common air and inflammable air when burnt together not producing acid, by supposing that the heat produced is not sufficient. He then says that these experiments, with the exception of what relates to the acid, were made in the summer of 1781, and mentioned to Dr. Priestley, and adds, that "a friend of his (Mr. Cavendish's) last summer (that is 1783) gave some account of them to Mr. Lavoisier, as well as of the conclusion drawn from them, that dephlogisticated air is only water deprived of its phlogiston; but at that time so far was Mr. Lavoisier from thinking any such opinion warranted, that till he was prevailed upon to repeat the experiment himself, he found some difficulty in believing that nearly the whole of the two airs could be converted into water." The friend is known to have been Dr., afterwards Sir Charles Blagden; and it is a remarkable circumstance, that this passage of Mr. Cavendish's paper appears not

* Mr. Warltire's letter is dated Birmingham, 18th April, 1781, and was published by Dr. Priestley in the Appendix to the 2d Vol. of his "Experiments and Observations relating to various branches of Natural Philosophy; with a continuation of the Observations on Air,"—forming in fact the 5th volume of his "Experiments and Observations on different kinds of Air," printed at Birmingham in 1781.

Mr. Warltire's first experiments were made in a copper ball or flask, which held three wine pints, the weight 14 oz.; and his object was to determine "whether heat is heavy or not." After stating his mode of mixing the airs, and of adjusting the balance, he says he "always accurately balanced the flask of common air, then found the difference of weight after the inflammable air was introduced, that he might be certain he had confined the proper proportion of each. The electric spark having passed through them, the flask became hot and was cooled by exposing it to the common air of the room; it was then hung up again to the balance, and a loss of weight was always found, but not constantly the same; upon an average it was two grains."

He goes on to say, "I have fired air in glass vessels, since I saw you (Dr. Priestley) venture to do it, and I have observed, *as you did*, that, though the glass was clean and dry before, yet, after firing the air, it became dewy, and was lined with a sooty substance."

As you are upon a nice balancing of claims, ought not Dr. Priestley to have the credit of first noticing the dew?

In some remarks which follow by Dr. Priestley, he confirms the loss of weight, and adds, "I do not think, however, that so very bold an opinion, as that of the latent heat of bodies contributing to their weight, should be received without more experiments, and made upon a still larger scale. If it be confirmed, it will no doubt be thought to be a fact of a very remarkable nature, and will do the greatest honour to the sagacity of Mr. Warltire. I must add, that the moment he saw the moisture on the inside of the close glass vessel in which I afterwards fired the inflammable air, he said, that it confirmed an opinion he had long entertained, viz. that common air deposits its moisture when it is dephlogisticated."

It seems evident that neither Mr. Warltire, nor Dr. Priestley, attributed the dew to anything else than a mechanical *deposit of the moisture suspended in common air.*

* Mr. Cavendish's note, p. 127, would seem to imply this; but I have not found in any of Dr. Priestley's papers that he has said so.

to have been in it when originally presented to the Royal Society, for the paper is apparently in Mr. Cavendish's hand, and the paragraph p. 134, 135, is not found in it, but is added to it, and directed to be inserted in that place. It is moreover not in Mr. Cavendish's hand, but in Sir Charles Blagden's, and indeed the latter must have given him the information as to Mr. Lavoisier, with whom it is not said that Mr. Cavendish had any correspondence. The paper itself was read 15th January 1784. The volume was published about six months afterwards.

Mr. Lavoisier's memoir (in the Mem. of the Académie des Sciences, for 1784) had been read partly in November and December 1783, and additions were afterwards made to it. It was published in 1784. It contained Mr. Lavoisier's account of his experiments in June 1783, at which, he says, Sir Charles Blagden was present; and it states that he told Mr. Lavoisier of Mr. Cavendish having "already burnt inflammable air in close vessels, and obtained a very sensible quantity of water." But he, Mr. Lavoisier, says nothing of Sir Charles Blagden having also mentioned Mr. Cavendish's conclusion from the experiment. He expressly states, that the weight of the water was equal to that of the two airs burnt, unless the heat and light which escape are ponderable, which he holds them not to be. His account, therefore, is not reconcilable with Sir Charles Blagden's, and the latter was most probably written as a contradiction of it, after Mr. Cavendish's paper had been read, and when the Mémoires of the Académie were received in this country. These Mémoires were published in 1784, and could not certainly have arrived when Mr. Cavendish's paper was written, nor when it was read to the Royal Society.

But it is further to be remarked, that the passage of Mr. Cavendish's paper in Sir Charles Blagden's handwriting, only mentions the experiments having been communicated to Dr. Priestley; they were made, says the passage, in 1781, and communicated to Dr. Priestley, it is not said when, nor is it said that "the conclusions drawn from them," and which Sir Charles Blagden says he communicated to Mr. Lavoisier in summer 1783, were ever communicated to Dr. Priestley; and Dr. Priestley in his paper (referred to in Mr. Cavendish's), which was read June 1783, and written before April of that year, says nothing of Mr. Cavendish's theory, though he mentions his experiment.

Several propositions then are proved by this statement.

First, That Mr. Cavendish in his paper, *read 15th January, 1784, relates* the capital experiment of burning oxygen and hydrogen gases in a close vessel, and finding pure water to be the produce of the combustion.

Secondly, That in the same paper he drew from this experiment the conclusion, that the two gases were converted or turned into water.

Thirdly, That Sir Charles Blagden inserted in the same paper, with Mr. Cavendish's consent, a statement that the experiment had first been made by Mr. Cavendish in summer 1781, and mentioned to Dr. Priestley, though it is not said when, nor is it said that any conclusion was mentioned to Dr. Priestley; nor is it said at what time Mr. Cavendish first drew that conclusion. *A most material omission.*

Fourthly, That in the addition made to the paper by Sir Charles Blagden, the conclusion of Mr. Cavendish is stated to be, that oxygen gas is water deprived of phlogiston; this addition having been made after Mr. Lavoisier's memoir arrived in England.

It may further be observed, that in another addition to the paper, which is in Mr. Cavendish's handwriting, and which was certainly made after Mr. Lavoisier's memoir had arrived, Mr. Cavendish for the first time distinctly states, as upon Mr. Lavoisier's hypothesis, that water consists of hydrogen united to oxygen gas. There is no substantial difference perhaps between this and the conclusion stated to have been drawn by Mr. Cavendish himself, that oxygen gas is water deprived of phlogiston, supposing phlogiston to be synonymous with hydrogen; but the former proposition is certainly the more distinct and unequivocal of the two: and it is to be observed that Mr. Cavendish, in the original part of the paper, *i. e* the part read January 1784, before the arrival of Lavoisier's, considers it more just to hold inflammable air to be phlogisticated water than pure phlogiston.

We are now to see what Mr. Watt did, and the dates here become very material. It appears that he wrote a letter to Dr. Priestley on the 26th April 1783, in which he reasons on the experiment of burning the two gases in a close vessel, and draws the conclusion, "that water is composed of dephlogisticated air and phlogiston deprived of part of their latent heat."* The letter was received by Dr. Priestley, and delivered

* It may with certainty be concluded from Mr. Watt's private and unpublished letters, of which the copies taken by his copying-machine then recently invented, are preserved, that his theory of the composition of water was already formed in December, 1782, and probably much earlier. Dr. Priestley, in his paper of 21st April, 1783, p. 416, states, that Mr. Watt, prior to his (the Doctor's) experiments, had entertained the idea of the possibility of the

to Sir Joseph Banks, with a request that it might be read to the Royal Society; but Mr. Watt afterwards desired this to be delayed, in order that he might examine some new experiments of Dr. Priestley, so that it was not read until the 22d April, 1784. In the interval between the delivery of this letter to Dr. Priestley and the reading of it, Mr. Watt had addressed another letter to Mr. De Luc, dated 26th November, 1783,† with many further observations and reasonings, but almost the whole of the original letter is preserved in this, and is distinguished by inverted commas. One of the passages thus marked is that which has the important conclusion above mentioned; and that letter is stated in the subsequent one to have been communicated to several members of the Royal Society at the time of its reaching Dr. Priestley, viz. April, 1783.

In Mr. Cavendish's paper as at first read, no allusion is to be found to Mr. Watt's theory. But in an addition made in Mr. Cavendish's own hand, after Mr. Watt's paper had been read, there is a reference to that theory (Phil. Trans. 1784, p. 140), and Mr. Cavendish's reasons are given for not encumbering his theory with that part of Mr. Watt's which regards the evolution of latent heat. It is thus left somewhat doubtful, whether Mr. Cavendish had ever seen the letter of April, 1783, or whether he had only seen the paper of (26th November, 1783) of which that letter formed a part, and which was read 29th April, 1784. That the first letter was for some time (two months, as appears from the papers of Mr. Watt) in the hands of Sir Joseph Banks and other Members of the Society during the preceding spring, is certain, from the statements in the Note to p. 330; and that Sir Charles Blagden, the Secretary, should not have seen it seems impossible, for Sir Joseph Banks must have delivered it to him at the time when it was intended to be read at one of the Society's meetings (Phil. Trans. p. 330, Note), and as the letter itself remains among the Society's Records in the same volume with the paper into which the greater part of it was introduced, it must have been in the custody of Sir C. Blagden. It is equally difficult to suppose, that the person who wrote the remarkable passage already referred to, respecting Mr. Cavendish's conclusions having been communicated to Mr. Lavoisier in the summer of 1783 (that is, in June), should not have mentioned to Mr. Cavendish that Mr. Watt had drawn the same conclusion in the spring of 1783 (that is, in April at the latest). For the conclusions are identical, with the single difference, that Mr. Cavendish calls dephlogisticated air, water deprived of its phlogiston, and Mr. Watt says, that water is composed of dephlogisticated air and phlogiston.

We may remark, there is the same uncertainty or vagueness introduced into Mr. Watt's theory which we before observed in Mr. Cavendish's, by the use of the term Phlogiston, without exactly defining it.* Mr. Cavendish leaves it uncertain, whether or not he meant by Phlogiston simply inflammable air, and he inclines rather to call inflammable air, water united to phlogiston. Mr. Watt says expressly, even in his later paper (of November, 1783), and in a passage not to be found in the letter of April, 1783, that he thinks that inflammable air contains a small quantity of water and much elementary heat. It must be admitted that such expressions as these on the part of both of those great men, betoken a certain hesitation respecting the theory of the composition of water. If they had ever formed to themselves the idea, that water is a compound of the two gases deprived of their latent heat,

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conversion of water or steam into permanent air. And Mr. Watt himself, in his paper, Phil. Trans. p. 335, asserts, that for many years he had entertained the opinion that air was a modification of water, and he enters at some length into the facts and reasoning upon which that deduction was founded.

† The letter was addressed to Mr. J. A. De Luc, the well known Genevese philosopher, then a Fellow of the Royal Society, and Reader to Queen Charlotte. He was the friend of Mr. Watt, who did not then belong to the Society. Mr. De Luc, following the motions of the Court, was not always in London, and seldom attended the meetings of the Royal Society. He was not present when Mr. Cavendish's paper of 15th, January, 1784, was read; but, hearing of it from Dr. Blagden, he obtained a loan of it from Mr. Cavendish, and writes to Mr. Watt on the 1st March following, to apprise him of it, adding that he has perused it, and promising an analysis. In the postscript he states, "In short, they expound and prove your system word for word, and say nothing of you." The promised analysis is given in another letter of the 4th of the same month. Mr. Watt replies on the 6th, with all the feelings which a conviction he had been ill-treated was calculated to inspire, and makes use of those vivid expressions which M. Arago has quoted; he states his intention of being in London in the ensuing week, and his opinion, that the reading of his letter to the Royal Society will be the proper step to be taken. He accordingly went there, waited upon the President of the Royal Society, Sir Joseph Banks, was received with all the courtesy and just feeling which distinguished that most honourable man, and it was settled that both the letter to Dr. Priestley of 26th April, 1783, and that to Mr. De Luc, of 26th November, 1783, should be successively read. The *former was done on the 22d*, and the *latter on the 29th April, 1784.*

* Mr. Watt, in a note to his paper of 26th November, 1783, p. 331, observes "previous to Dr. Priestley's making these experiments, Mr. Kirwan had proved by very ingenious deductions from other facts, that inflammable air was in all probability the real phlogiston in an aerial form. These arguments were perfectly convincing to me, but it seems proper to rest that part of the argument on direct experiment.

—that is, of the two gases, with the same distinctiveness which marks Mr. Lavoisier's statement of the theory such obscurity and uncertainty would have been avoided.*

Several further propositions may now be stated, as the result of the facts regarding Mr. Watt.

First, That there is no evidence of any person having reduced the theory of composition to writing, in a shape which now remains, so early as Mr. Watt.

Secondly, That he states the theory, both in April and November 1783, in language somewhat more distinctly referring to composition, than Mr. Cavendish does in 1784, and that his reference to the evolution of latent heat renders it more distinct than Mr. Cavendish's.

Thirdly, That there is no proof, nor even any assertion, of Mr. Cavendish's theory (what Sir C. Blagden calls his conclusion) having been communicated to Dr. Priestley before Mr. Watt stated his theory in 1783, still less of Mr. Watt having heard of it, while his whole letter shows that he never had been aware of it, either from Dr. Priestley, or from any other quarter.

Fourthly, That Mr. Watt's theory was well known among the members of the Society some months before Mr. Cavendish's statement appears to have been reduced into writing, and eight months before it was presented to the Society. We may, indeed, go farther, and affirm, as another deduction from facts and dates, that, as far as the evidence goes, there is proof of Mr. Watt having first drawn the conclusion, at least that no proof exists of any one having drawn it so early as he is proved to have done.

Lastly, That a reluctance to give up the doctrine of Phlogiston, a kind of timidity on the score of that long-established and deeply-rooted opinion, prevented both Mr. Watt and Mr. Cavendish from doing full justice to their own theory, while Mr. Lavoisier, who had entirely shaken off these trammels, first presented the new doctrine in its entire perfection or consistency.*

All three may have made the important step nearly at the same time, and unknown to each other; the step, namely, of concluding from the experiment, that the two gases entered into combination, and that water was the result; for this, with more or less distinctness, is the inference which all three drew.

But there is the statement of Sir Charles Blagden to show that Mr. Lavoisier had heard of Mr. Cavendish's drawing this inference before his (Mr. Lavoisier's) capital experiment was made;† and it appears that Mr. Lavoisier, after Sir C. Blagden's statement had been embodied in Mr. Cavendish's paper had made public, never gave any contradiction to it in any of his subsequent memoirs which are to be found in the Mémoires de l'Académie, though his own account of that experiment, and of what then passed, is inconsistent with Sir Charles Blagden's statement.‡

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* Mr. Watt, in his letter of 26th April, 1783, thus expresses his theory and conclusions (Phil. Trans. p. 333): "Let us now consider what obviously happens in the case of the deflagration of the inflammable and dephlogisticated air. These two kinds of air unite with violence, they become red hot, and, upon cooling, totally disappear. When the vessel is cooled, a quantity of water is found in it, equal to the weight of the air employed. This water is then the only remaining product of the process, and *water, light*, and *heat*, are all the products" (unless, he adds in the paper of November, there be some other matter set free, which escapes our senses). "*Are we not then authorized to conclude, that water is composed of dephlogisticated air and phlogiston, deprived of their latent or elementary heat; that dephlogisticated or pure air is composed of water deprived of its phlogiston, and united to elementary heat and light; that the latter are contained in it in a latent state, so as not to be sensible to the thermometer or to the eye; and if light be only a modification of heat or a circumstance attending it, or a component part of the inflammable air, then pure or dephlogisticated air is composed of water deprived of its phlogiston and united to elementary heat?*"

Is not this as clear, precise, and intelligible, as the conclusions of Mr. Lavoiser? [NOTE BY MR. JAMES WATT.]

The obscurity with which Lord Brougham charges the theoretical conceptions of Watt and Cavendish does not appear to me well founded. In 1784, the preparation of two permanent and very dissimilar gases was known. Some called these gases, pure air and inflammable air; others dephlogisticated air and phlogiston; and lastly, others, oxygen and hydrogen. By combining dephlogisticated air and phlogiston, water was produced equal in weight to that of the two gases. Wa'er thenceforward was no longer a simple body, but a compound of dephlogisticated air and of phlogiston. The chemist who drew that conclusion, might have erroneous ideas as to the intimate nature of phlogiston, without throwing any uncertainty upon the merit of his first discovery. Even at this day, have we *mathematically demonstrated*, that hydrogen (or phlogiston) *is an elementary body; or that it is not*, as Watt and *Cavendish supposed at the time*, the combination of *a radical and of a little water?* NOTE BY M. *ARAGO.*

* It could scarcely be expected that Mr. Watt, writing and publishing for the first time, amid the distractions of a large manufacturing concern, and of extensive commercial affairs, could compete with the eloquent and practised pen of so great a writer as Lavoisier; but it seems to me, who am certainly no impartial judge, that the summing up of his theory (p. 333 of his paper), here quoted is equally luminous and well expressed as are the conclusions of the illustrious French chemist.

† In the letter which Sir Charles Blagden addressed to Professor Crell, and which appeared in Crell's *Annalen* for 1786, professing to give a detailed history of the discovery, he says expressly, that he had communicated to Lavoisier the conclusions both of Cavendish *and Watt*. This last name appears in that letter for the first time in the recital of the verbal communications of the Secretary of the Royal Society, and is never mentioned by Lavoisier.

‡ Could Blagden's letter to Crell also have escaped Lavoisier's notice?

But, there is not any assertion at all even from Sir C. Blagden, zealous for Mr. Cavendish's priority as he was, that Mr. Watt had ever heard of Mr. Cavendish's theory before he formed his own.

Whether or not, Mr. Cavendish had heard of Mr. Watt's theory previous to drawing his conclusions, appears more doubtful. The supposition that he had so heard rests on the improbability of his (Sir Charles Blagden's), and many others knowing what Mr. Watt had done, and not communicating it to Mr. Cavendish, and on the omission of any assertion in Mr. Cavendish's paper, even in the part written by Sir C. Blagden with the view of claiming priority as against Mr. Lavoisier, that Mr. Cavendish had drawn his conclusion before April, 1783, although, in one of the additions to that paper, reference is made to Mr. Watt's theory.

As great obscurity hangs over the material question at what time Mr. Cavendish first drew the conclusion from his experiment, it may be as well to examine what that great man's habit was in communicating his discoveries to the Royal Society.

A committee of the Royal Society, with Mr. Gilpin the clerk, made a series of experiments on the formation of nitrous acid, under Mr. Cavendish's direction, and to satisfy those who had doubted his theory of its composition, first given accidentally in the paper of January, 1784, and afterwards more fully in another paper, June, 1785. Those experiments occupied from the 6th December, 1787, to 19th March, 1788, and Mr. Cavendish's paper upon them was read 17th April, 1788. It was, therefore, written and printed within a month of the experiment being concluded.

Mr. Kirwan answered Mr. Cavendish's paper (of 15th January, 1784,) on water, in one which was read 5th February, 1784, and Mr. Cavendish replied in a paper read 4th March, 1784.

Mr. Cavendish's experiments on the density of the earth were made from the 5th August, 1797, to the 27th May, 1798. The paper upon that subject was read 27th June, 1798.

The account of the eudiometer was communicated at apparently a greater interval; at least the only time mentioned in the account of the experiments is the latter half of 1781, and the paper was read January, 1783. It is, however, probable, from the nature of the subject, that he made further trials during the year 1782.

That Mr. Watt formed this theory during the few months or weeks immediately preceding April, 1783, seems probable.† It is certain that he considered the theory as his own, and makes no reference to any previous communication from any one upon the subject, nor of having ever heard of Mr. Cavendish drawing the same conclusion.

The improbability must also be admitted to be extreme, of Sir Charles Blagden ever having heard of Mr. Cavendish's theory prior to the date of Mr. Watt's letter, and not mentioning that circumstance in the insertion which he made in Mr. Cavendish's paper.

It deserves to be farther mentioned, that Mr. Watt left the correction of the press, and everything relating to the publishing of his paper, to Sir Charles Blagden. A letter remains from him to that effect written to Sir Charles Blagden, and Mr. Watt never saw the paper until it was printed.

† *That the idea existed in his mind previously, is* proved by his declarations to Dr. Priestley, cited by the latter; by his own assertions, p. 335 of his paper, and by the existing copies of his letters in 1782.

RICHARDS'S IMPROVED PROCESS OF MANUFACTURING WHITE LEAD.

[Report of the Committee of the *Franklin Institute*.]

According to this process, the necessary apparatus consists of one chamber within another, the inner or lead chamber being tiled on its inner side, and completely surrounded by a twelve inch bank of tan on the sides, floor, and roof, between which and the outer chamber, steam is allowed to circulate to maintain the temperature of the lead chamber at an elevated point. The sheets of lead are rolled up in the ordinary manner, flattened at one end, and set upright on the other on floors or shelves. A trough crossing the centre of the floor of the inner chamber, contains the vinegar, and may be said to have a double bottom, from small openings on either side of which air and carbonic acid are forced into the chamber. A similar hollow beam crosses the roof, permitting the entrance of steam from small lateral openings. For the first twelve hours after setting the lead, steam is allowed to enter, mingled with a small quantity of air, giving the lead a greyish white surface, while the mass remains unaltered. Acetic acid is now introduced into the trough, and steam and air continued for three days. During the following sixteen days, vinegar is still added, till the whole has amounted to one pint for three pounds of lead; and at the same time the steam is continued, while air and carbonic acid are forcid into the apartment, the latter being generated by the

combustion of coke. After these operations, the surface of the lead is greyish white and somewhat hard, the interior of the sheet containing, still, metallic lead. Up to this point, a period of twenty days, the temperature has been maintained at 120° Fahr., but during the remainder of the process, it should not be higher than 80° to 90° Fahr. During the remaining 15 days, equal volumes of air and carbonic acid are forced in, and a small quantity of steam admitted. The whole process, therefore, requires thirty-five days for its completion, when, if it has been well conducted, the surface of the lead will be covered with minute blisters, otherwise large scales of a white compound, probably an acetate, stand off from the surface of the metal.

It is generally acknowledged by those who have investigated the manufacture of white lead by acetic acid, that the theoretic character of the process is involved in much obscurity. The experience in Europe, as deduced from direct experiment, has been that the entrance of atmospheric air tends to darken the colour of the resulting white lead, but Mr. Richards asserts that he cannot succeed without it; and yet it is difficult to explain its action, excepting by its assisting in the oxidation of the metal. If oxidation proceed from the vapour of water or vinegar, we must suppose the disengagement of hydrogen, or carburetted hydrogen, an evolution that actually takes place at times in the dung process, and converts oxide of lead, on the external surface of the pots, to a metallic state. But we cannot suppose the quantity of these gases to be great, since the above result is only observed at intervals, when the process is not altogether successful. Now, as we know that a subcarbonated oxide of lead may be formed by the simple action of air and water or steam, which is the first step in Mr. Richards's process, and since we know that these bodies must be present, to a certain extent, in all methods for manufacturing white lead, we need not resort to acetic acid alone for the requisite oxygen, as is frequently done in the theories that have been advanced on this subject. Nor can we suppose, with any more reason, that carbonic acid arises from the vinegar alone, or in great quantity, and we have moreover abundant evidence to show the necessity of introducing carbonic acid generated from some other source. We are farther aware, from experience, that carbonic acid, air and water, will produce white lead, but that the combination of acetic acid with the water expedites the operation, with the production of a much superior article. From these premises, therefore, we draw the conclusion that the lead becomes oxidized chiefly from air and water, and only in part from the vinegar; that it then combines with free carbonic acid; and that the water, or its vapour acts in part by keeping the substance formed in a softer state, thereby forwarding action on the remainder. But we may farther ascribe another and important action to the vinegar, by supposing it to combine with the oxide of lead, which has arisen in the manner above stated, constituting an acetate of lead, which is simultaneously decomposed by carbonic acid, in a manner similar to the French method of precipitating a subacetate, by passing carbonic acid gas through its solution. It is true, that in this latter case, a subcarbonate is formed from the subacetate, but if a subacetate be formed in the common process, it may be converted into the neutral carbonate, or common white lead, from the excess of carbonic acid present, and the length of time it remains in contact with it in a moist state,—or carbonic acid may have the power of decomposing a neutral acetate at the moment of its formation, thus producing a neutral carbonate. These theoretic views relative to the manufacture of white lead, are offered by the committee, in the hope that they may lead to a closer investigation of the subject, which may result in much practical benefit to the community.

The ordinary process for white lead by means of manure beds, is attended by many disadvantages—the breakage of the pots—the difficulty of setting them well by workmen—the amount of uncorroded lead remaining,—to which we may farther add, the greater or less uncertainty of the amount of heat and of carbonic acid, excepting after lengthened practical experience. The method consists in the evolution of carbonic acid by the putrefactive fermentation of organic matter, and in the simultaneous generation of heat, which vapourises acetic acid and water, and promotes chemical action. Whether it will be superseded by the process for passing these vapours into a chamber heated by steam, must be determined by a comparison of results. The white lead in either case, appears to be of equal quality, and with an increase of twenty-five per cent. on the metallic lead employed. By the dung process, the metallic matter remaining amounts to ten per cent. when well performed, and averages fifteen per cent., excepting the *failings*, which are converted into litharge and red lead. Mr. Richards states that his remainder does not exceed ten per cent. On this subject, however, it may be remarked, that where the lead is well *set* in the common method, it may be corroded to a considerable depth, for the committee have obtained specimens of white lead nearly half an inch in

thickness, made by Mr. J. P. Wetherill, by setting a solid pig of lead in the dung bed. The committee have seen a comparative estimate of expenses, which leaves a balance in favour of the newer processes, but they believe that such an estimate cannot determine the relative values of the two, and that the execution of the new method on a large scale can only prove its superiority to that so long employed with success. In fact, Mr. Richards's mode of manufacture differs from the other, not by a difference of principles, but by a novel application of them. It has a decided superiority in point of neatness, and would also have in regard to accuracy, if the relative action of the agents were sufficiently understood, for we may introduce given quantities of each into the lead chamber, and maintain it at a given temperature. Indeed, it is the latter circumstance on which he chiefly relies for successful practice, and in which his process differs from others resembling it in other respects; and the committee deem his arrangement of heating by steam, convenient and manageable, although they are incapable of judging of its expense.

MEANS OF REDUCING THE PRICE OF PUBLIC CLOCKS.

A report by M. Francœur, on behalf of the Committee on the Mechanic Arts of the Societé d'Encouragement, attests that the committee is persuaded of the utility which the public will find in the fabrication of the new clocks of M. Wagner, rue du Cadran; that they perform with exactitude and safety, and that the execution is in all parts complete.

The reporter remarks that the expense of at least from 1000 to 1200 francs is an obstacle to many churches, manufactories, and large edifices in the procuring of a public clock, and suggests that the reduction of price by M. Wagner to 3 or 400 francs, wherever there is a clock on which the hours may be struck, may open the way for overcoming it. At Moret there is a manufactory of what are called *Jura clocks*, in which all the pieces of the mechanism are made in the large way, and all made to fit; wheels, weights, bells, dial plates, hands, hammers, &c., are made, set up, and delivered in the market for 40 francs, and the clock goes very well. This great establishment has changed the face of the surrounding country, increasing the population, the erection of new buildings, and the general prosperity. The Jura clocks are acknowledged to keep as good time as can be expected from works of this kind, especially when the escapement, as is done by Wagner, has been retouched.

This apparatus is transformed by Wagner into a public clock, which strikes the hours on any required bell, by a hammer proportioned to its size. This is done by adding to the Jura clock a mechanism which answers the desired purpose.

To comprehend the play of this mechanism, imagine an addition to the Jura clock, consisting of a heavy striking weight, hammer, and fly to moderate the descent of the weight, and a very simple mechanical connexion of these with the clock. A lever retains the heavy weight, which lever is held in its place by the wheel work of the common striking part of the clock. As soon as the hammer of the clock is set free to strike the hour, the lever which holds the heavy weight is freed, and by the descent of the latter, the great hammer is set in motion, and which, as a consequence, will strike as many blows as the hammer of the clock. Thus as many strokes will be heard on the great bell, as the clock itself strikes, which has no other action on the mechanism connected with the great bell than to give it leave to speak. The hour will thus be struck twice, which is not an advantage to be despised, since it costs nothing, and is often useful.

A large dial plate and hands must be added to the Jura clock, adapted to its height or distance to be seen. The great number of public clocks, constructed on this principle, leaves no doubt of the utility of the invention.—*Annales des Mines.*

NEW MODE OF PREPARING CARBURETTED HYDROGEN FOR THE PURPOSE OF ILLUMINATION.

This new invention has gained for M. Selligue the premium of 2000 francs proposed by the Societé d'Encouragement. It consists in obtaining pure hydrogen by decomposing water by means of incandescent charcoal, and then carburizing it by mixture during the simultaneous decomposition, of another liquid substance rich in carbon and hydrogen. Among all known substances, that which appears to answer best is the oil of schist, (l'huile de schiste.)

The furnace is composed, 1st, of three vertical retorts, communicating with each other, so as to form, in a manner, only one. In a double furnace there will be six retorts. These are all open at both ends, but closed below by sliding stoppers *(couvercles rodès)*, so that simple contact and the least pressure is sufficient to shut them firmly. The top

of each retort is closed by a head fixed by keyed gudgeons and iron cement. Each head bears itself a stopper, or cover, like those below.

The first retort into which steam is introduced through a tube, communicates below, by a tube twice bent, with the second, which connects at top with the third by a similar tube, and this third retort has, below, a vertical tube with branches, by which the gas is conducted to a refrigerator, and thence to the gasometer. This tube dips into a trough of water, to serve as a hydraulic closure. The third retort bears at top a funnel syphon, through which the carburizing substances are introduced. 2d. Two horizontal tubes, placed in the sides of the vault, serve as boilers to vapourize the water; each communicates at one end with the first retort by an arched tube, and to the other end is attached a funnel syphon, by which the boiler is supplied with water. 3d. Two furnaces. 4th. A chimney in four parts, uniting at first into two, and then into one, in order to regulate the fire with greater ease.

Operation.—Having filled with charcoal the first two retorts in each of the (double) furnaces, and suspended chains in the two last, in order to increase the surface, the fire is lighted, and when the retorts have attained a cherry red heat, a gentle flow of water and oil is made through the syphons. The water falling into the boilers is instantly evaporated, passes into the first retort, then into the second, where it is deprived of its oxygen, and reaching the third, the hydrogen alone mingles with and carries along the carbonated hydrogen simultaneously formed from the oil in the last retorts. The united gases then issue from the lower end of the third retort, and press off through the branches, while the more volatile matters are deposited in the reservoir of water.—*Annales des Mines.*

EMBOSSED LEATHER ORNAMENTS AND MOULDINGS.

Mr. J. Esquilant has communicated to the Society of Arts the following method of making ornaments to substitute for carvings in wood, and castings, composition or metal, or for those made of *papier maché*:—

The ornaments are flowers, fiolage, and fruit, arranged in wreaths or groups, and copied from nature with sufficient accuracy to be at once recognizable. They are entirely relieved from the plain surface on which they are placed, resembling in their general appearance the highly raised carvings in wood by Gibbons and other artists of the last century.

Metal moulds of separate leaves, and of the various petals and other pieces of which flowers are composed, are to be prepared. A piece of leather of the required thickness, is to be cut to the proper form and size of the intended leaf, and is then to be soaked for a day or two in a solution of rosin in common oil of turpentine. When the leather is fully impregnated with the liquor, it is to be taken out and wiped, and then cold-pressed in the mould with sufficient force to give it the intended figure: it hardens as it dries by the evaporation of the essential oil, and, when once dry, retains its form without warping afterwards on exposure to damp or draught. The separate pieces are then put together by ties and glue, and finally are covered with a coat of paint, varnish, or gilding. For representing fruits, he employs sawdust ground in a mill to fine powder, and mixed up to the consistence of putty with glue and a little rosin and turpentine. This composition may be moulded either by hand, or by pressure into moulds: when dry, it has the appearance, and more than the hardness, of wood. For flowers with thin petals, such as roses and carnations, he often uses rolled zinc, shaped to the proper figure by compressing the parts separately in a mould, and then cementing them together. Leather, prepared as above described, has the following advantages over wood or *papier maché*; with a degree of hardness at least equal to either of these substances, it is so tough as not to be liable to chip by a blow, and may therefore be made to stand out from the surface to which it is applied in the highest relief, without the risk of damage; and the cost, all things being considered, is very moderate.

NOTES AND NOTICES.

Height of Waves.—M. Alme has presented a memoir to the French Academy of Sciences, in which he gives the results of his experiments on the depth to which the motion of waves extends, made in the Bay of Algiers, from December, 1838, to July, 1839, during the continuance of the heavy north and north-east winds which caused such a great swell in the bay. He concludes—1st, That the motion of the sea produced by the agitation of the waves may be sensible 40 yards in depth; 2dly, That the motion at the bottom is oscillatory; and 3dly, That the extent of this oscillation varies slowly from the bottom to the surface.

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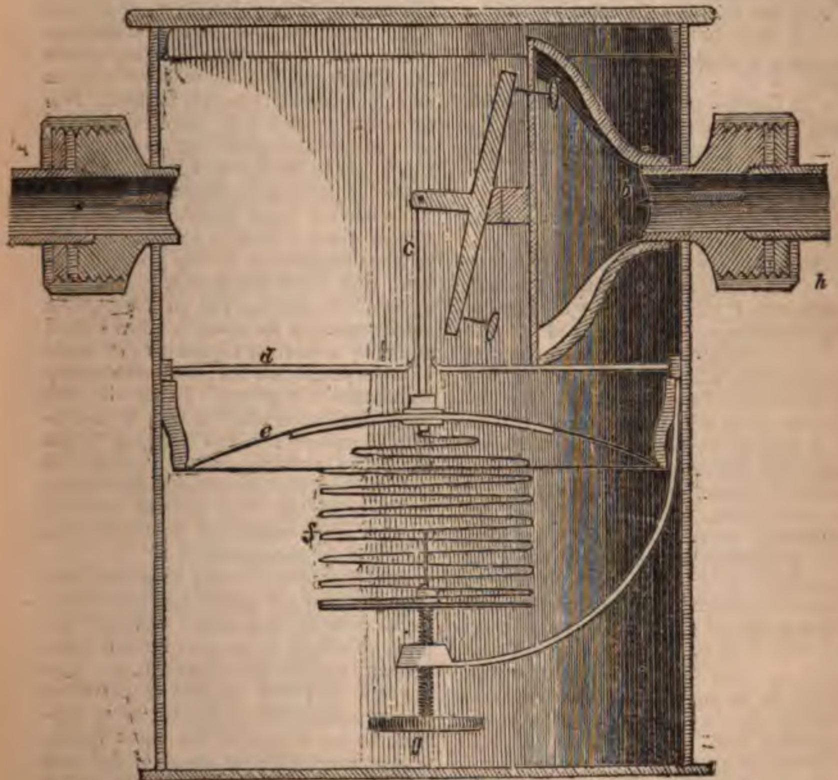
BACON'S PATENT GAS MODERATOR.



BACON'S PATENT GAS MODERATOR, AND REMARKS ON REGULATING THE SUPPLY OF GAS TO BURNERS.

Sir,—I beg leave to draw your attention to the instrument described below, devised for the purpose of regulating the light of gas burners. You are, doubtless, aware that a water governor applicable to this purpose was one of the inventions of Mr. Clegg. The "Moderator" is a dry governor, and acts without the aid of water or any other fluid.

Description of the Engraving.—(See front page.)

a. The gas inlet pipe.

b. The valve regulating the supply of gas to be admitted.

c. A rod working the valve.

d. A false bottom for receiving any deposits arising from impurities in the gas.

e. A flexible membrane, coated with gold leaf, and screwed gas tight to the rod *(c)* above, and to a small metal disc below.

f. A spiral spring.

g. An adjusting thumb screw.

h. The outlet pipe.

Action of the Moderator.—By means of the adjusting screw *g* acting through the spring *f*, the metal disc attached to the membrane *e* and the rod *c*, the valve *b* is in the first instance kept at that opening which is just sufficient to let through the supply required for the burners at an average pressure.

Whenever an increase of pressure occurs from any cause, as from irregularities in the main, or from the putting out of lights, &c., it is instantly felt by the flexible membrane, which gives way, and transmits the pressure through the metal disc to the spring, forcing it to contract. By the same movement the rod *c* is carried down and made to close the valve *b*, shutting out the superfluous gas. As soon as the pressure again abates the spring is relieved, and re-opens the valve by forcing up the disc, membrane and rod.

From the above description it will appear that the object of the Moderator is to render the flames of gas-burners steady and uniform throughout the night. Most of your readers are familiar with the abrupt and singular fluctuations that occur in the light of gas burners. At one period of the evening, for example, all the gas lights used in a shop or dwelling-house are observed to burn low, and with a feeble illuminating power. In vain the attendant opens the stop-cocks by which the gas is admitted to the burners. He finds it impossible to increase the height of the flames, or to obtain more light. For several hours, perhaps, the inconvenience continues unabated, and the gas burners only serve to render the "darkness visible," when lo! in an instant the flames mount up without any assignable cause, diffusing volumes of smoke and of unconsumed gas through the apartment. The tradesman now experiences inconveniences of an opposite, but of a still more serious description. His ceilings and fine goods are soiled with smoke; white surfaces are blackened; cutlery, jewellery, plate, and other bright goods are tarnished and corroded; and the colours of fancy goods are discharged, and the material itself in some instances irreparably injured. Nothing but prompt and immediate attention to the stop-cocks serves to reduce the flames to their proper height, and to abate the growing nuisance.

To such of your readers as have not turned their attention to the principles of gas illumination, it may probably appear that these inconvenient and disagreeable variations are an inseparable consequence of the system. But I shall show, by a familiar explanation of some of those principles, that these effects may be obviated altogether. I may add, that the investigation which it will be necessary to pursue for this purpose is not one of an abstruse nature, though it is one replete with interest and instruction, and presents the best method that occurs to me of rendering intelligible the uses of the "moderator."

Coal gas, after having been extracted from the coal and purified, is distributed to the different consumers through the pipes of supply by means of mechanical pressure applied at the gas works. It is obvious that this propelling power or pressure cannot be so applied as to prevent the occurrence of the most inconvenient inequalities of supply in different localities, and at various hours of the night.

1. The same pressure which scarcely conveys an adequate quantity of gas to feed the burners of the distant consumer (living, perhaps, several miles from the works) necessarily carries a superabundant supply to the inhabitants of the immediate neighbourhood.

2. But the most active cause of change in the height of gas lights is the alteration that occurs in the pressure itself by which the gas is impelled. Early in the evening a comparatively light pressure is put on; but at a later hour, as the night closes in, the demand for gas increases, and a heavier pressure is applied. Again later still, from nine to ten o'clock, the shops having closed, the demand for gas is diminished, and a lighter pressure is sufficient to meet the demand thus abated. It will readily be understood, that these variations in the pressure at the works, though serving to adjust the supply of gas pretty accurately to the *general* demand, are, nevertheless, calculated to produce the most unpleasant oscillations in the flames of *individual* gas burners.

3. Coal gas, being lighter than atmospheric air, has a tendency to rush with rapidly increasing velocity into high situations. Hence the highest burners in a range of lights will frequently be observed to exhibit an excessive height of flame, while the rest of the range are emitting a feeble light.

4. A peculiar source of disturbance is created by the occasional extinction of the lights of some large establishment causing the gas they generally consume to produce an excess in the burners in the neighbourhood.

The preceding explanation will, I trust, render it plain even to the uninitiated in the mysteries of gas illumination, that the unpleasant fluctuations in the height of gas flames arise entirely from the want of some means for the correction of the inequalities which occur in its distribution. The superior splendour of gas light compared to that obtained from wax, oil, or tallow, is universally admitted; it is more economical, and moreover it is certain that, when the gas is properly purified, it cannot be more injurious to health, because the chemical products resulting from its combustion are the same as are produced when the above mentioned substances are burnt.* But the chang[illegible] the height of gas flames hav[illegible] in objection which has f[illegible]ormed an excluded gas [illegible] the most part and from [illegible]rom private houses [illegible] many public establishments. This objection, which has hitherto very much impeded the progress and diminished the profits of those who are interested in gas works, will, it is believed, be obviated by the use of the instrument now described. Like the throttle-valve of the steam-engine, the "moderator" is calculated to attain the two important ends of securing economy of material and uniformity of supply.

Having enumerated the existing defects in the system of gas illumination, which have rendered necessary the adoption of some apparatus for correcting local irregularities in the distribution of gas, I shall proceed briefly to illustrate the mode in which the "Moderator" effects this object, and to point out the benefits it confers on gas consumers and also on gas companies.

I will suppose the case of a shop or warehouse, situate very near the gas works by which it is supplied. In such a locality, the occupants (as before observed) are suffering from the constant evil of excess. The laws which regulate the transmission of gas or any other aerial body through pipes, are, in many respects, precisely the same as those which apply to the flow of a stream of water through pipes or in its natural channel—the bed of a river. For example, if a flood takes place in one of our great rivers, in consequence of a sudden fall of rain near its source, the effects of the inundation are, in the first instance, most severely felt by the districts immediately adjoining the river's head, while, in the more distant parts of its course, the flood is dissipated as it proceeds, so as to produce comparatively little injury in the neighbouring tracts of country, or, at all events, the mischief is there felt more slowly. Now, a gas consumer, who lives near the gas works is affected by every change in th[illegible], sure at the works, for prec[illegible] pres- reason; he is clo[illegible]ely the same head" of th[illegible] to the "fountain chan[illegible] *aerial current*, and every [illegible] in its quantity or momentum, originating at its source, is felt by him immediately, while such changes are but slowly and faintly perceived by those who live at the extremities of the current. In situations near the works, nothing but the most vigilant and incessant attention to the stop-cocks can render the use of gas safe or endurable. Generally speaking, it appears to [illegible]

* See a *very valuable little work* "Hints to Gas-consumers," *Parker, West Strand.*

well established, that the burning of gas is attended with less danger than the use of candles; the latter give rise to numerous accidents by sparks, the falling of ignited portions of the wick, and the facility with which they may be moved from place to place, which puts it in the power of careless attendants to leave them in dangerous situations. It must, on the other hand, be admitted, that, in those localities where the changes of pressure are rapid and extreme, occasional want of attention to the stop-cocks may lead to the most serious consequences. Now, the great advantage of the Moderator is, that it performs the functions of a "*self-acting stop-cock.*" Once regulated, so as to suit the burners it is intended to control, it neutralizes the effect of additional pressure, and renders all attention to the common stop-cock unnecessary from the commencement of the evening till its close. The comfort and security thus produced, where the consumer has been suffering from excess of pressure, are too obvious to require further remark. He is enabled to unite the advantages of a copious supply with those of regularity and cleanliness, he always enjoys a brilliant and, at the same time, a safe and unvarying light, while his attendants are released from the necessity of constantly watching the flames of the burners to attend to other duties.

It cannot be doubted, that the general use of this instrument by individuals exposed to the evils of an excessive supply, would serve indirectly to benefit those who suffer from the opposite evil of deficiency. This will readily be understood. By every fresh addition of pressure large quantities of gas are forced through the pipes and burners of the immediate neighbours of the gas company, and are thus wasted before the cocks can be readjusted. The gas thus thrown away would, by the self-acting power of the Moderator, be repelled or rather *detained* in the street mains, and would form an addition to the "stock" of gas which is conveyed through those channels to the distant consumer. This effect has been displayed very strikingly on a small scale. It should be premised, that it not unfrequently happens, that the opposite inconveniences of deficiency and excess are exhibited in the very same house—the burners in one apartment being more favourably situated, are often found to take away the greater part of the supply which enters the house from the street mains, causing the lights in adjoining apartments, fed by the same service pipe, to dwindle and burn dim. When this effect occurs, it is generally ascribable to the influence of elevation, and not to the different force with which the pressure at the works is felt. I have alluded to the mode in which the current of a river is affected, as a popular illustration of some of the causes which disturb the flow of gas; but in this particular instance, the influence of *height*, the analogy ceases altogether. Water being heavier than atmospheric air, has a tendency to descend and seeks the lowest place it can attain; and hence low situations are apt to suffer by the inundation of a stream as much as, and in some cases even more, than the particular district where the flood first originates. Coal gas, on the other hand, is specifically lighter than atmospheric air, and hence it rises in any pipes opening into the atmosphere just as oil ascends to the surface when mixed with water. Moreover, the gas, as it rises, acquires fresh momentum at every stage of its ascent, on the same principle that water or a solid body descending by the force of gravity obtains a gradually accelerated velocity.

A statement of this simple principle will give to your readers an interesting explanation of a difficulty which has probably perplexed and surprised many, viz.:—Whence it comes to pass that the gas burners in the highest stories of a house are generally best supplied with gas, while the ground floor, and, perhaps, even the first story, though both nearer to the gas works, are very indifferently illuminated. (This phenomenon is often observed to take place even when the service pipe passes *through* the lower apartments, and thence is transmitted to the upper stories.) The reason is, that the impulse derived by the gas from its natural tendency to ascend in the atmosphere, constitutes a moving force more powerful even than the momentum it acquired at the works. Hence it rushes to high elevations in preference even to situations more closely adjoining the gasometer. The action of the Moderator has been favourably displayed in correcting these irregularities.

By placing one of these instruments so as to regulate the lights of the upper rooms in a house, it has been found, that, while the lights in these rooms were kept down to a proper height, the lower apartments were also better illuminated, the supply being equalised throughout the premises. As already suggested, it is plain that similar effects on a large scale would, to a certain extent, be produced, were the lights in the immediate vicinity of the gas works properly regulated; the distant consumer would obtain thereby a more copious supply.

Enough has been said to show the advantage of this invention to the public at large. To gas companies it will probably present a new field for their capital and enterprise, by removing the chief objection that has hitherto existed to the use of gas in private houses. It will open to them the mansions of our aristocracy, from which gas has hitherto been excluded on account of the objections before alluded to, because in those princely residences elegance and refinement are more exclusively consulted than splendour and display.

I remain your obedient servant,

INVESTIGATOR.

London, Nov. 2, 1839.

THE CALCULATOR, NO. 6. EXTENSION OF POWER IN THE SLIDING RULE.

The operation of the slide rule in its simple form applies only to the solution of such questions as may be computed in the equation $x = \frac{a\,c}{b}$, with a few modifications as pointed out in this Magazine, vol. vii, p. 250.

But, more complex expressions, involving not more than three variable quantities (a b, c) may, (without using a second slide,) be brought within the scope of the rule, if capable of being changed into the form $x = \frac{a\,c}{v}$, wherein v is some function of $\frac{a}{b}$; in this way :—

Find the expression for $\frac{a}{b}$ in terms of v, and lay down upon the rule, or on the slide, a line corresponding to such expression, so that its divisions may be cut by the end or other fixed point on the *other part of the instrument*. Suppose it to be put in the groove beneath the slide, and to be denoted by Z; also let $\frac{b}{a} = q$. Then,

A |	q		b
B |	1		a

A |			x
Z |	q |	B |	a

Thus many formulæ, in which the signs + or — interfere so far as to require the aid of the pen to an inconvenient extent, may be put into a shape, for ready solution by the rule alone.

Of this I give some examples—

1. *The relation of the Sides of Right Angled Triangle.*—This is a case of great frequency among artificers, and other practical men. If c, stand for the hypothenuse, it is well known that $c^2 = a^2 + b^2$. In that form, the simple lines (known as A.B.) afford no assistance. With a double line C and a single D, we can obtain the squares of two of the sides separately, then take their sum or difference by the pen, and again, use the rule to obtain the root, or third side. Now let the formula be altered thus, $c = a\sqrt{\left(\frac{b^2}{a^2} + 1\right)}$ and let a line (K) be graduated, so that any division (n) may stand against $\sqrt{(n^2 + 1)}$ on line A, the solution may then be had by the lines A, B, K only, without pen, or mental operation, thus—

A |	q	b	[or c]
B |	1	a	

A |			c	[or b]
K |	q |	B |	a	

2. *Cask Gauging.*—Many forms for this are to be found in treatises. As applied to the rule, they mostly consist in determining an intermediate quantity between the bung and head diameters, and using this as a mean diameter, in conjunction with the ordinary gauge point for cylinders. Now Dr. Hutton has given a general rule, to which he assigns the highest rank for accuracy and facility. As applicable to imperial measure, and dimension taken in inches, it is this: $C = {\cdot}000031473\,L(39\,B^2 + 25\,H^2 + 26\,BH)$. This looks unpromising enough for the slide rule. But, put $\frac{H}{B} = q$, and let $\frac{1}{v^2} = {\cdot}0007868\ (q^2 + 1{\cdot}049 + 1{\cdot}56)$

then $C = \frac{LB^2}{v^2}$: which can be worked upon the lines C D. The line X, which for this purpose it is necessary to lay down in the groove, is in fact a line of special gauge points, applicable to the different proportions between B and H; and it requires very little space, for we have the highest guage point 21·5 standing against 6·882 on A, with a graduation descending until the ordinary number 18·79 corresponding to 10 on A, being the case where $\frac{H}{B} = 1$, or the cask is a cylinder. The gauging of a cask will be thus:—

A	head diameter	
B	bung diameter	X | special g. p.
C	content, galls.	length
D	bung diameter	gauge point found

3. *Content of Pyramidal Frustrum.*—In these days of railroad-making, the problem is of constant application to the computation of earth cuttings and embankments. Mr. Bidder, C.E., has published an ingenious table for this special object. He divides a cutting of 1 chain length into two portions, the middle part forming a trapezoidal section (to which the slide rule is easily applied) and the two slopes composing together a square pyramidal frustrum.

Now the general rule for this solid is, $\frac{1}{3} l (a^2 + a b + b^2)$. When a and b are given in feet, the length in chains, and the content is required in cubic yards, it becomes $\frac{22}{27} l (a^2 + a b + b^2)$. It is easy to see that this case differs from that of the cask, only in the co-efficients, and being dealt with in a similar manner, the result is a line V (for the groove of the rule) in which 1·0 stands against 1·9085 on A, 0·8374 against 5·0, and 0·6396 against 10·0, and whereby we have—

A	feet width of slope at greater end,	
B	feet width of slope at lesser end	V | special g. p
C	cubic yards content,	chains length.
D	feet greater width	gauge point found.

I have only to add, that no trace of the theory now expounded has been found in any essay on the slide rule, nor any practical application of it, except to the case first treated of in this article. A gentleman who lately published on the slide rule, lent me a small tract (without author's name or date) entitled, "The Art of Measuring made Easy." It is intended to accompany a rule having brass extra slide, on one side of which is an inverted line A, and on the other, a line like what I have denominated K. The tract explains how this line is to be applied to the finding of "hyps" of roofs, and similar cases of right angled triangles, but gives not the slightest explanation of its principle. Moreover, the line being put upon an extra slide, persons might suppose that it was necessarily moveable in relation to the common lines, which would be erroneous.

I once saw a rule having this brass extra slide, and it was called a "Patent Rule." Perhaps some reader of the Mechanics Magazine would give some information respecting it, it being desirable to assign a date.

J. W. Woollgar.

Lewes, Nov. 8, 1839.

ON A NEW RAZOR SHARPENER.

Sir,—In the number of your Magazine for October 3d, 1835, vol. 24, p. 8, No. 634,) I proposed a very simple machine for sharpening razors, which professed merely *to combine* the principles and advantages of the common knife-sharpener, and of Mr. Knight's steel. I had then given it only a short trial; since that time I have had full opportunity for ascertaining its merits, and I am satisfied that it answers the purpose better than any other contrivance with which I am acquainted. For a description of this machine, those of your readers who are sufficiently interested in the matter may turn to the number of your Magazine just referred to; to others it may be sufficient to say, that it consists

of two cast-steel balls in contact with each other, which are fixed in a frame.

With respect to the construction of this instrument, I think the best size for the balls will be about one inch in diameter, and the frame should be made to dip so low where its sides oppose the space between the balls, as to prevent the possibility of the edge of the razor coming in contact with it when drawn between them. The action of this machine on the edge of the razor is chiefly, but not wholly, that of a burnisher: it wears the edge more than the strap (as will be, in a short time, visible to the extent of about the tenth of an inch), and may, in some measure, though not wholly, be made to supersede the hone; it also acts mechanically in straightening the edge of the razor, which, after having been used, will be felt, while passing between the balls, to be in some places bent.

The method of using this razor-sharpener, formerly proposed, was simply this —that a little putty powder and oil, about the consistence of a thin paste, was to be placed between the balls, and the edge of the razor drawn lightly a few times between them from heel to point. I have since found that the edge of the razor was sometimes left a little rough, and therefore the putty powder should be well levigated before it is mixed with the oil. But a better substance, or I may say the best which I have tried for the same purpose, is the burnt wick of a candle, which is frequently employed for razor-strops. I have tried this alone, and mixed with putty powder and oil; but the simple plan of cutting off with a pair of scissars a small portion of the burnt wick of a candle, perhaps a little below the top, and inserting it between the balls, seems to admit of no improvement; and this being, under all circumstances at hand, it may be found, as in travelling, to be a convenience that nothing else is required. The razor should consist of, perhaps, the hardest steel; its sides should be concave, and its edge thin; on being first drawn between the balls, the edge will be felt to be rough, or perhaps bent. When it is felt to pass through without the least sense of roughness or impediment, the operation may be discontinued, and the putty powder and oil, or whatever other substance is used, may be strapped off on the hand. *If the razor is a good one, it will not* require the repetition of this oftener than once in three or four days, it being sufficient in the meantime to strap it on the hand, or on very soft linen, or perhaps leather. The instrument for sharpening it should be held by the handle in the left hand, and both it and the razor should be perpendicular, or else inclined at the same angle. In a short time, perhaps in the course of two or three weeks, the edge of the razor will be found to be a little dull, when, instead of being drawn between the balls from heel to point, it may be necessary to pass it backwards and forwards, proceeding gradually from the heel to the point. This should be done with a light hand, or with the least possible pressure. The edge of the razor will soon be felt to be smooth throughout; it may then be drawn lightly three or four times between the balls, and strapped, as before directed, on the hand. The edge of the razor will, after this operation, be thinner than before; but although the use of the hone will be rarely required, I do not think it can be wholly dispensed with.

Since the time of my first communication on this subject, I have made many comparative trials of the efficacy of this machine with the contrivances, for the same end, previously in use, and have invariably preferred the former—the employment of any other being much more troublesome, and the effect upon the edge of the razor altogether so inferior, that the use of it, under the disadvantages of this comparison, has been almost intolerable. However trifling these remarks may appear, I trust their usefulness will form an apology for their occupying a small space in your Magazine.

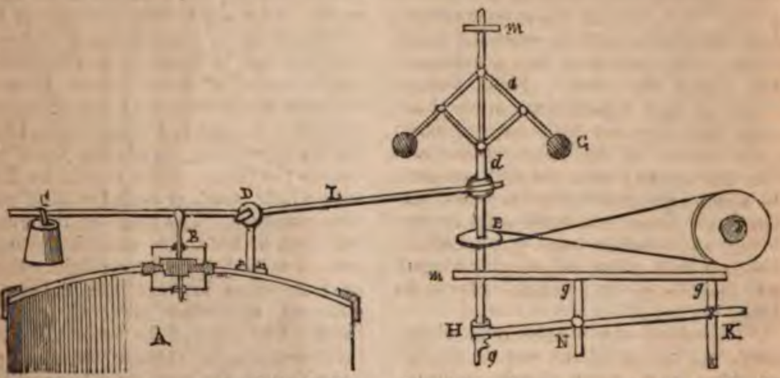
D. P.

November 10, 1839.

SELF-ACTING SAFETY-VALVE OPENER FOR STEAM VESSELS.

Sir,—Trusting that any attempt, however humble, to remove the existing causes of steam boiler explosions, will meet with your approbation, I send the following plan, which if it possess no other merit than that of originality, it perhaps may be the means of suggesting something calculated to do away with those calamitous occurrences, which have of late been alas, too frequent. It was sug-

gested by an article in your 787th numbsr, concerning a new law for the prevention of steam boiler explosions, which says:—That the master or owner shall be liable to a penalty, if the safety valve be not opened every time the engine is stopped to take in, or land goods or passengers. Now I would recommend the substitution of a mechanical movement for the personal attention of the engineer—in short, I propose that the stopping of the engine should immediately effect the opening of the safety valve.



Let A represent a part of the boiler; B, the safety valve; C, the weight, and D, the joint on which the steelyard lever works. Then let G represent a governor, to be placed in any convenient situation near the boiler; F, the main driving shaft with a grooved wheel, to give motion to the sheave E and governor G, by means of a strap; the points of suspension of the weights of the governor are fixed to the driving spindle at *a*, and consequently the socket *d*, slides down every time the weights colapse, carrying with it the lever L, and lip D; which lip having a stud projecting under the steelyard lever C of the safety-valve carries it along with it, and relieves the safety-valve of the weight. This would act every time the engine stops.

Now as it is necessary to have the safety-valve shut whilst the steam is being got up, the lever N and its apparatus is for that purpose; *m*, *m*, are bearings in which the governor works, allowing it also to move up or down; the lever moves on a pivot at N, and at its extremity H is a shoe with a steel centre for the governor to work in; at the other end of the lever is a rack K, having two notches into which the lever is made to spring to retain it in the place where it is put; a little bracket *g* under the shoe H, bears the weight of it when it is down; *g*, *g*, are fixtures to fasten the lever and governor to. It will be seen then by examination of the drawing, that when the end of the lever N is lowered it will raise the shoe H, and with it the governor, thereby relieving the lever C of the safety-valve from the lip D. Hoping a reference to the drawing will render further explanation unnecessary,

I have the honour to be,

Sir, your obedient servant,

William Wynn.

Beverley, Sept. 10, 1839.

ADMIRAL BULLEN'S MINERS' SAFETY NET.

Sir,—The dreadful catastrophe that happened very lately in one of the coal-pits at Radstock, from the breaking of the rope by which the men descend and ascend the pit, has induced me to consider seriously what means might be used that would be likely to prevent the repetition of similar melancholy accidents, and I send you the result of my reflections. My plan is as follows:—Instead of *one rope* by which the men descend and ascend the pit, I would recommend *two*, both of equal size and strength; *one* I would call the working rope, to which

the hooks and other contrivances are fixed, for the men to sit on as they descend and ascend the pit; the other rope I would call the *safety rope*, and to which I attach a net bag made of suitable strong rope and large meshes; this bag should envelope the men as they sit on the hooks, and are suspended by the *working rope*. Now, should the working rope break, the men would be received into the net, and saved from being precipitated down the shaft. These ropes should be tied together at proper distances, that they may both work parallel in the groove of the large sheave or roller that is fixed over the pit's mouth. The *safety rope* may work for years, as there is no strain and little chafing on it; but the *working rope* gets weaker every day, and at last separates, perhaps with destruction of human life and limbs.

If you think my contrivance at all worthy the notice of the public, I beg you will insert it in your valuable Magazine.

I am, Sir, your humble servant,

JOSEPH BULLEN, Rear-Admiral.

Bath, Nov. 13, 1839.

CASING FOR GAS AND WATER PIPES TO PREVENT THE NECESSITY OF BREAKING UP ASPHALTE FOOT PAVEMENTS.

Sir,—The durability of the several kinds of asphalte laid down for foot pavements in various places, appears to have been well tested, and I have no doubt that the application of it to that purpose will become general; should it be so, some such plan as the following must be adopted to prevent the necessity of continually breaking it up for the purpose of repairing the gas and water pipes laid on to the different houses, as appears to have been the case lately in that piece in Whitehall. An iron pipe, A A, of about 3 or 4 inches in diameter, bedded in the gravel, &c., on which the asphalte B is laid, a foot or so from the surface, and extending from the interior of the front wall C of each house to the curb of the pavement. This will be sufficiently large to contain the gas and water services D E, and should any defect occur in the length, they can be drawn out and replaced by new. The *expense would be but trifling, for old and unserviceable* gas pipes might be used, as they are not required to be sound.

Of course it is presumed that the

roadway is formed as at present, and easily taken up, though it would be well if something could be done to obviate the necessity for this, for no good and permanent road can ever be made while the liability exists of its daily being disturbed to get at the pipes beneath.

Your constant reader,

J. R. F.

105, Upper Thames-street,
November 4, 1839.

WOOLWICH INSTITUTION FOR THE ADVANCEMENT OF LITERARY, SCIENTIFIC, AND MECHANICAL KNOWLEDGE.

We have read with much interest in the *Woolwich Advertiser*, a very cleverly-conducted journal which has been recently established in that place, a report of the first annual meeting of the above Institution, which was held on Tuesday, the 29th ult. The President of the Institution is our much-esteemed friend and correspondent Dr. Olinthus Gregory, who is very deservedly complimented by the *Advertiser* upon occupying the latter days of his long and useful career "in ministering so discreetly and judiciously to the best interests of all who have discernment to avail themselves of the benefits derivable from his invaluable observations and example." Mr. Christie, who succeeded Dr. Gregory in the Professorship of the Royal Military Academy, Woolwich, is one of the Vice-Presidents. An exceedingly suitable address was delivered on this occasion by Dr. Gregory. It is of too great length to be transferred to our pages, but our readers will be pleased with the following extracts:—

"Let it be borne in mind that all men need knowledge; when they *feel* that need they will remove it, and they never remove it so thoroughly and effectually as when, either from the first, or after they have received all the advantages which seminaries and colleges furnish, they become their own instructors. Men, whether to acquire knowledge, or to extend what they already possess, must become self-instructors; and the sooner that process is commenced, with right views, the more certain it is that success will attend their efforts. Let it further be recollected, that, with correct views of *his native wants, and his native powers, any man may learn any thing.* I mean to request your attention, by and by, to some proofs of this truth."

* * * * *

"Dr. G. then proceeded to enumerate several instances illustrating the acquisition of knowledge by humble individuals, and the advantages thence resulting to themselves and society at large. (The well-known cases of James Watt, Edmund Stone, and James Ferguson.) He next successively described the case of a labourer on the turnpike road, who had become an able Greek scholar;—of a journeyman tin-plate worker, who invented rules for the solution of cubic equations;—of a country sexton, who became a teacher of music, and who, by the higher principles to which he was excited, simultaneously with his love of the theory of musical science, as well as of its practice, was transformed from a drunken sot to an exemplary husband and father;—of a blind man, the late Mr. John Gough, of Kendal, who became a profound mathematician, a very able chemist, and, which was still more extraordinary, a celebrated ornithologist, so much so, indeed, that the late Bishop Goodenough, of Carlisle, and others of high reputation in that department, often, in cases of difficulty, consulted that gentleman;—of a tailor, who was an excellent geometrician, and who discovered curves which had escaped the sagacity of Newton; with whom Dr. Hutton, Bishop Horsley, Dr. Maskelyne, and Baron Maseres delighted to converse on mathematical subjects, yet who laboured *contentedly* at his trade till nearly 60 years of age, when, by the recommendation of his scientific friends, he was first appointed master of Neale's Navigation School, and afterwards Nautical Examiner at the Trinity House;—of a ploughman, in Lincolnshire, who, without the aid of men or books, discovered the rotation of the earth, the principles of spherical astronomy, and invented a planetary system nearly similar to that of the Tychonic;—of a country shoemaker, who afterwards became distinguished as one of the ablest metaphysical writers in Britain;—of the son of a working carpenter, who was only at school for one half year, and *that* a night school, but is now one of the most able writers on mathematical science, and a professor in a college;—of another professor in one of our universities, who was originally a travelling pedlar, or packman."

* * * * *

"I have called your attention to these brief narratives, to establish in your mind the decided conviction that self-cultivation, commenced and pursued by a mind thirsting for knowledge, and with right principles, is productive of the highest advantages,

while it is greatly aided by such an institution as this. Let me observe farther, that all the individuals of whom I have spoken were of exemplary private conduct. Let me also ask you how much depression, doubt, inquietude, and difficulty, might most of them have saved, could they have availed themselves of such a society as I am now addressing? And again, what would have been lost to the occupation of a gardener, a tailor, a shoemaker, a shepherd, &c., if each of these had quitted his respective original pursuit ten years earlier than he did; that is, if he had so much earlier entered the path for which the great Director of all minds evidently intended him. And permit me, in conclusion, to entreat you to infer from all that I have been saying, how, in the economy of human life, *each depends upon all*, and thence to deduce a double lesson in favour of the cultivation of the arts and sciences, and the cultivation of universal benevolence."

A very novel and commendable feature of this Institution is the admission of the fair sex to a full participation in its benefits. The people of Woolwich have done themselves great honour by acting at once so sensibly and so gallantly.

WHITELAW *v.* ADAMS.—STEAM-ENGINE EXPANSION GEAR.

Sir,—I learn by the *Mechanics' Magazine* of August last, that one Isaac V. Adams, of Boston, U.S., has obtained an American patent for my plan of expansion gear for the steam-engine. This shows, in a striking manner, that it is possible an invention may be lost to one inventor, and another may get the whole benefit of it; and the case will partake of a suspicious character if the first inventor is foolish enough to submit his plan to any society of a similar sort to the "Royal Cornwall Polytechnic Society for the Encouragement of the Sciences," &c., who, instead of publishing inventions, publish long lists of the names of persons they "delight to honour," and who consider that a trifling sum of money sent to their society, is a more important thing than an account of a discovery. This is clearly shown by what they call their "Annual *Scientific* Report."

I will not accuse any member of the Royal Cornwall Polytechnic Society of having communicated my plan to Mr. Isaac V. Adams; but whether he obtained it in a surreptitious manner, or honestly invented it, I beg to state that the patent is not worth a penny to him, as I published it in the *Repertory of Patent Inventions* some years before, I believe, either Mr. A. or the Polytechnic Society knew any thing at all about it; and a patent for an invention "communicated by a foreigner residing abroad" is not legal in the United States.

I am, Sir, yours respectfully,
JAMES WHITELAW.

London, Nov. 8, 1839.

IMPROVED AGRICULTURAL IMPLEMENTS.

We extract the following notices of various new and improved Agricultural implements from the *Journal of the Agricultural Society*. The inventions were exhibited at the Oxford meeting, and evidence a considerable advance in this important, and until lately, much neglected branch of mechanics.

Messrs. Ransome's *Chaff-cutting machine.*—The largest and most powerful of its kind hitherto constructed: it is remarkable for the equable slicing-cut of the two knives, each three feet long, fixed on the fly-wheel, and for the method of advancing the straw. The first operation is effected by the peculiar form of the cutting-edge of the knives, which pass through the straw at the same angle with it from point to heel; and are so adjusted as to act with nice precision against the polished metal surface of the straw-box. The straw, which is stationary, and firmly compressed by the press-board during the cut, is advanced in the interval of one knife finishing and the other commencing its action. This operation is accomplished, very exactly and simply, by means of an elliptic wheel, driven by an eccentric circular one, whose motion is derived from a ratchet-wheel on the same axis acted on by a crank, so that the straw is forced rapidly forward; the press-board in front being at the same time raised to take off the friction, and brought down again by a powerful grip upon the straw whilst the knife passes through it. A contrivance is also adapted for varying the length of the chaff from three-eighths to an inch and a half in length. With the half-inch cut, it was stated to produce half a ton of chaff per hour, with the power of two horses, and so on in proportion to the length of the cut. This machine is equally applicable to steam or water as to horse power. Hand machines, of a similar construction, with one knife, were exhibited; as also others, cutting only one length of straw, which is advanced by a screw.

Mr. Biddell's *Scarifier.*—It consists of two rows of teeth, fixed in a strong iron frame, supported by a pair of average-sized wheels, and preceded by a pair of smaller. Chisel points are affixed to the tines, which are

movable, and hoes, of four and a half inches wide for partial hoeing, and nine inches wide to cut the land close, substituted as occasion may require. The form of the teeth is well adapted for bringing couch-grass to the surface without breaking; and it is represented by those who have used it as affording a great saving both in time and tillage—breaking and stirring eight acres per diem with four horses; and being more effective on strong lands than ploughing, as it occasions less treading by horses, and produces more mould. For the purposes also of slightly paring stubbles after harvest, to prevent the seed-weeds from vegetating, and for working summer fallows, it will doubtless be found a very effective implement.

Mr. Clarke's *Universal Ridge-plough*. This plough is capable of assuming four different forms, suited to four different purposes; and although, in most cases, an implement answers its purpose best when constructed for one purpose only, yet in this case the plough well admitted the variations, and was as perfect, and as well adapted to its several uses in each of its shapes as if it had been made expressly and only for that one purpose. The first view of this plough was in the form of a 'double-tom,' for earthing up plants sown on wide ridges, or opening water-furrows. In the second a change of the mould-boards was made, and it became a moulding-plough, of a smaller and more hoe-like description, for going between plants closely planted, loosening the soil, and earthing them up. In the third, it was a skeleton or broad-share plough, to which shares with curved lines were affixed, for the purpose of clearing land from weeds, &c. In the fourth, it became an excellent expanding hoe, with a double-winged share in front, with curved coulters for cleaning the sides of the ridges, and hoes to be used with or without the coulters as occasion may require.

Messrs. Garrett and Son's *Suffolk-drill*, has a simple invention to perfect the delivery of the corn when the seed is damp, or when lime or other material is mixed with it. This is effected by a small piece of iron like a pendulum, which is suspended over each set of cups in the cylinders, and which strikes the handle of each cup as it delivers the corn, which is then shaken completely out. This drill has also a swing lever to move the coulters to either side when drilling land which is not level, and so constructed as to be easily transformed to different sizes.

Mr. Grounsell's, (of Louth,) Drop-drill, ceived a silver medal from the society for the novelty and value of the principle involved. This drill has an inner wheel attached to the main wheel of the implement, which, at stated intervals, acts upon a crank, which withdraws a slide from each cup, on the principle of a shot-belt, and deposits the manure at given distances, thereby greatly economising artificial manures, such as bones. This machine is evidently capable of much improvement, but it may be expected to engage the attention of mechanics, as the object to be attained is extremely desirable. When moved by hand, it appeared to deposit the manure very regularly at a foot distance, but probably the more rapid pace of a horse would have let it down in a more continuous stream. This may, however, be in a great measure obviated by increasing the diameter of the inner wheel.

Mr. T. Salter's (of Hallingbury) *Corn-dressing machine*, was commended by the judges, and the society's silver medal was awarded to it. This machine receives the corn in an inclined wire cylinder, through which it is driven by an iron revolving rod armed with short knives, which entirely supersede the use of the common barley-chopper, breaking the beard or tail off barley or oats, and separating the dirt and seeds from the chaff. It is then delivered into the sieves attached, through which the blowers drive a very considerable force of wind. The whole may be worked by two men, one to turn the wheel and the other to serve the hopper.

The "*Scorcher*," a newly invented machine, invented by Messrs. Jones and Draper, of Chorlbury, for burning straw, weeds, on the ground, or even charring the soil after harvest, attracted the observation of the curious. It was about three feet wide, on wheels, containing a fire-box and a fan, by which the flame was driven through a narrow aperture.

MODE OF MAKING THE NEW FRENCH PHOSPHORIC MATCHES.

On the subject of these matches, the Committee of Health and Safety in Paris remark as follows, relative to their fabrication:—

"Every body is acquainted with the new and elegant matches which, on account of their convenience and cheapness, are now preferred to all others. They may be said to have totally supplanted the red matches. They inspire, it is true, some fear of danger, but when examined closely, we find this fear to be unfounded. The first matches were naturally very imperfect. They took fire on the slightest friction, and sometimes on a simple exposure to the sun. It was, therefore, with reason that Councellor Troustrof awakened public attention to the danger of

using them; and yet the fabrication of these matches has not been the less prosperous.

"The friction matches now sold may be strongly shaken in the box containing them without inflaming. They ought not certainly to be given to children as playthings; but if governments were to be influenced by these considerations they must interdict the use of flint and steel, and must watch with especial care the manufactories, to prevent the sale of sulphur, sulphuric acid, burning glasses, ceruse, &c. &c., which would involve them in the ridiculous.

"Our aim in publishing this article is to enable our readers to partake in the advantages of so useful an invention, by communicating the following process. We should observe, that although these matches may not be dangerous, they ought not, nevertheless, to be kept in heaps, nor should governments allow them, under any pretext, to be fabricated in the large way in a town or near dwelling-houses, for the least negligence might cause a fire which could not be extinguished, and even making them in a small way, the greatest care ought to be used.

"*Preparation.*—Put a quantity of mucilage of gum arabic into an earthenware vessel and heat it to the temperature of 40° or 50° C. (= 100 to 125 Far.) and to four parts of the mucilage add one part of phosphorus: it instantly melts; stir it so as to mix it well with the mucilage, and when well divided, add chlorate of potash in powder, nitrate of potash and a little Benzoin, so as to form a soft paste: into this dip the ends of the match sticks. The mass constitutes what is called *fulminating tinder*."

Observations.—The editors of the French Journal designate a number of grave accidents which have occurred in Paris in consequence of these matches, such as fires, loss of eyes, &c., and urge the expediency of an injunction on the part of the administration, that they be manufactured in localities detached from other buildings, and if possible in fire-proof rooms; that they be packed and sold only in separate boxes, and to recommend that no more paste be used than is sufficient for inflammation, and when transported to a distance that they be inclosed in solid cases, and the contents carefully marked as in the regulation for percussion caps.

Some prohibitory police regulations on this subject would doubtless be advisable in our cities and villages. The committee appointed by the corporation of New York to investigate the causes of fires, ascribe a number of their annual conflagrations to the imprudent use of these matches.

We were offered lately in the streets of Pittsburgh a kind of loco-foco matches which were new to us, and were told that they are made by the cart load on the Monongahela river. A block of dry wood about one inch and a half long on each side, is sawn (but not entirely through) in two directions, so as to leave more than a hundred detached upright pieces each the size of a match. The ends of these are dipt together in the paste, and when a match is wanted it is broken from the block. Being thus detached they can be transported with much less danger than when in compact bunches. They ignite by friction on almost any surface, and burn as if containing phosphorus. The composition *may be* the same as that given in the above recipe.—*Franklin Journal.*

THE ROYAL GEORGE OPERATIONS.

The detachment employed at Spithead, in the demolition of the Royal George, disembarked at Woolwich Dock Yard on Thursday, having come round in the Medea steam frigate, under charge of Serjeant Major Jones. The successful operations against the Royal George are concluded for this season. But it is intended to recommence operations in the month of May next. The operations and experiments carried on against this vessel have proved highly important; inasmuch as the superiority of the Voltaic Battery over all other means for subterraneous explosions has been completely established. The expedient of the leaden pipe, with Mr. Howe's ingeniously contrived union screw joints, Bickford's Fuse, and all the rest of the paraphernalia, must vanish before the never-failing and scientific Voltaic Battery.

The art of removing the wrecks of sunken vessels by gunpowder has been now brought to as much perfection and certainty as the operation of mining in dry soil; and it must be highly gratifying to the corps of Royal Sappers and Miners, from the satisfactory conclusion of these interesting experiments, that they are the first on record as having destroyed sunken vessels by means of gunpowder. We allude to the Arethusa, of Liverpool, a ship of 350 tons, which was blown to pieces by this corps, under the directions of Major (now Lieut.-Colonel and Governor of Bermuda) Reid, at Barbadoes, after the memorable hurricane of 1831. We believe, however, that Dr. Hare, of Philadelphia, has the merit of being the first to apply the Voltaic agency to such like and other useful practical purposes.

There has been consumed during these experiments 12,940 lbs. of powder. Above 100 tons of the wreck have been removed, and deposited in the Dock yard at Portsmouth, also five brass, and six iron guns, more than sufficient to cover the expenses incurred by Colonel Pasley.

These experiments have been conducted in a manner highly creditable to Colonel Pasley, and the engineer department. Too much praise cannot be given to Lieutenant Symonds, Serjeant Major Jones, and to the non-commissioned officers and privates employed in carrying out the working details, and as the duties have been of a most arduous, difficult, and dangerous nature, it is to be hoped that the remuneration will be commensurate with these circumstances.—*Woolwich Advertiser*. Nov. 9.

ON THE TRACTIVE POWER OF THE HORSE.

BY ELLWOOD MORRIS, C.E.

[From the *Franklin Journal* for August.]

There are perhaps but few subjects concerning which writers on practical mechanics differ more essentially than in stating the mean tractive force capable of being maintained by horses in common working hours from day to day.

Practical men seeking to apply horse power to various purposes, find upon resorting to books, such discrepancies as shake their confidence in the statements, even of the most respectable authorities, and induce them rather to assume for themselves an empirical standard.

At first view it would appear that a power of such antiquity, so commonly employed, and apparently so susceptible too of direct appreciation by experiment, would long since have received a determination, closely approximating to accuracy.

A nearer examination, however, developes difficulties growing out of the variety in muscular strength, to be noticed among horses even of the same weight, the difference in the capacity of prolonging exertion or keeping up a given pull for stated periods, which may be found amongst those of equal momentary strength, and the difficulty in experiments of registering the direct draught, owing to the traction being effected by *impulses*, "or strokes of the animals' shoulder against the collar," as aptly stated by an eminent writer.*

Another source of difference, much to be regretted, is that our authors do not always tell us, whether or not the tractive force given by them is the *effective draught* clear of friction.

The following Table 1, exhibiting the tractive force of the horse as stated by various authors,† shows considerable differences, and might be further extended, but that we have not the books at hand. In compiling this table, we observe that Mr. Smeaton's determination of a horse's power is stated at 250 hhds. of water *actually lifted* 10 feet high by pumps in one hour by one horse. We have therefore thought ourselves authorised in adding $\frac{1}{5}$ to this result for the friction of the pumps. The statements of the other authorities quoted, we take to be *total draught*, including friction.

TABLE I.

1	2	3	4	5	6	7
Direct Draught.	Speed per hour.	Duration of the draught or hours wrought per day.	Pounds lifted one foot high per minute.	Effect in lbs. lifted one foot high per day of the stated number of working hours without deduction for friction.	Authorities.	Species of draught.
lbs.	Miles.	Hours.	lbs.	lbs.		
200	2½	8	44,000	21,120,000	Emerson.	Over a pulley.
125	2½	8	27,500	13,200,000	Desagulier.	Unknown.
150	2½	8	33,000	15,840,000	Boulton and Watt.	do.
121 7-10	2½	8	26,774	12,851,520	Smeaton.	Pumping water.
163	2½	8	35,860	17,212,800	Bevan.	In ploughing matches.
112	2	10	19,712	11,827,200	Wood.	On Rail Roads.
125	3	6	33,000	11,880,000	Tredgold.	do.
90¼	*2½*	*8*	*19,855*	9,530,400	Leslie.	Common horse.
156¼	*2½*	*8*	*34,375*	16,500,000	ditto.	Picked do.

* *John Macneill, Esq. C, E., &c.* See *Trans. Inst. Brit. Civ. Eng.*

† See *Emerson's Mechanics; Allen's Mec.; Gregory's Math.; Wood on Rail Roads; and Tredgold on Rail Roads.*

Having for the last two years daily witnessed the application of horse power, to hoisting weights by simple machinery, we have thought it would not be without interest to practical men, to state the usual results of the labour of horses, under the circumstances referred to. It will at least be adding another direct fact to the information we now possess in regard to the tractive force of those animals.

The horse draught to which we allude is applied to gins (at the tunnel now constructing on the Chesapeake and Ohio Canal) in hoisting out by open buckets the water which accumulates in the shaft workings. The particular shaft where our experiments were made, is 188 feet deep, and usually has a hoist (clear of water surface in the sumph) of 178 feet. Two buckets are worked in this shaft, by ropes winding in reverse order around a drum, so that when one bucket is ascending, the other is descending, the direction of the horse's motion being reversed at the banking of each successive bucket, so as to produce on the whole, a reciprocating circular motion.

Dimensions about the Gin.

Hoist clear of the sumph....... 178 feet.
Circumference of gin rope drum.. 29.15 feet.
Ditto of gin horse path.. 89.85 "
Ratio of motion of horse to that of the bucket.............. 548 to 178
Circumference of the hemp rope 5 inches.
Cubic contents of water in each bucket as it usually reaches top shaft .... $8\frac{4}{10}$ cub. ft.
Average friction of the gin, with the buckets empty in lbs. applied at the horse's yoke..... $23\frac{1}{2}$ lbs.
Average friction of the gin when loaded with $8\frac{4}{10}$ cubic feet of water, (525 lbs.) and moving at the usual pace, in pounds, applied with a steady pull to the horse's yoke .... 26 lbs.
Ratio of the additional friction ($2\frac{1}{2}$ lbs.) to the applied weight, (525 lbs.) .... $\frac{1}{210}$ of the weight.

The following Table II, exhibits the mean results of four different series of experiments gone ito with the view of ascertaining the actual average draught of the gin horses working during one "miner's shift," or 8 hours out of 24.

The draught noted in the table below, is inclusive of the friction of the machinery, rigidity of the cordage, &c.,which at a mean of twelve experiments, proved to be equal to 26 lbs. when the load was 525 lbs. as before stated.

All the experiments were made with two different animals (Nos. 1 and 2) of medium size and strength for ordinary horses.

TABLE II.

1	2	3	4	5	6	7	8
Experiments.	No. of the horse.	Total time of horse hitched up.	Time lost in every way per shift of 8 hours.	Time per shift of horse actually hoisting the weight.	Pace of the horse whilst actually lifting the weight in miles per hour.	Average draught while actually hoisting.	Dynamical effect produced by one horse in lbs. lifted one foot high per day of 8 working hours, without deduction for friction.
		Hours.	h. m. s.	h. m. s.	Miles.	Pounds.	Pounds.
Average of the first series.	1	8	2 38 00	5 22 0	2.321	$196\frac{1}{2}$	12 922 384
Average of the 2nd series.	2	8	2 16 12	5 43 48	1.956	$196\frac{1}{2}$	11 628 399
Average of the 3rd series.	1	8	2 8 0	5 52 0	2.265	$196\frac{1}{2}$	13 768 566
Average of the 4th series.	2	8	2 0 0	6 0 0	2.076	$196\frac{1}{2}$	12 923 349

The actual amount of water lifted from the workings, by each horse in 8 hours work, and hoisted 178 feet, was found to be, *on an average of all the experiments, near 62,475 lbs.* or = 11,120,550 lbs. lifted *one foot* high per day.

In performing the above work from day to day, we have noticed that the horses em-

ployed barely kept in condition, thus signifying that they were working near to their maximum power.

We may divide horses generally into two classes, *picked* and *common*. And referring to tables I and II, and selecting from the first those results which seem most conformable to practice, we shall find that the dynamical effect produced by

Picked Horses.

According to Boulton and Watt,	= 15,840,000	Pounds lifted one foot high per day.
Ditto Bevan,	= 17,212,800	
	2)33,052,800	
Average	= 16,526,400	

Common Horses.

According to Desagulier,	= 13,200,000	Pounds lifted one foot high per day.
Ditto Smeaton,	= 12,851,520	
	= 12,922,384	
	= 11,628,399	
Do. gin horses C and O	= 13,786,566	
	= 12,923,349	
	6)77,312,218	
Average	= 12,885,369	

Whence finally we may perhaps take the mean day's work of horses when fully loaded.

Of *picked* horses at $16\frac{1}{2}$ *millions* of lbs. lifted one foot high per day.

Of *common* horses at $12\frac{9}{10}$ *millions* of lbs. lifted one foot high per day.

This average result for *common* horses is equal to a continued pull of near $135\frac{3}{4}$ lbs. at the rate of $2\frac{1}{4}$ miles per hour for* 8 hours out of 24.

The pace of $2\frac{1}{4}$ miles per hour, or more accurately 200 feet per minute, has been ascertained by the writer from numerous experimentsupon horses hauling earth for embankments in single carts, as well as from some trials with teams of four, to be that at which those in common use on public works, generally proceed when working with full effect.

Oldtown, Md., July 15, 1839.

FILTRATION OF HYDROGEN GAS THROUGH CAOUTCHOUC.

M. Cagniard-Latour, in experimenting on the permeability of membraneous envelopes, ascertained that a small balloon of caoutchouc, well prepared, appears to be completely tight to atmospheric air; *i. e.* once inflated, it remained so indefinitely; but that the same bottle filled with another gas—for example, oxygen, azote, carbonic acid or hydrogen, became very sensibly loose or uninflated. With hydrogen the collapse was more prompt than with the others.

In seeking for the cause of this rapid escape of hydrogen, he filled a balloon with it, and kept it for some time under water. In a few hours, the surface was nearly covered with small gaseous bubbles, and the size of the balloon appeared sensibly diminished. On examining the gas after its escape, it appeared to be the same as before, nor had the caoutchouc membrane undergone any alteration. The result appeared to be simply the effect of mechanical filtration.

The thickness of the balloon membrane in these experiments was only the fourth of a millimetre ($=\frac{1}{1000}$th of an inch), but the author had tried others much thicker, and found that when suitably compressed, hydrogen would escape through them.—*Franklin Journal.*

* The horses employed upon public works, *averaging the working time of* the whole year, are *worked nearly 10 out of 24 hours, for which time, however, they would only be able to exert a mean* force equal to a steady pull of about $108\frac{1}{4}$ lbs., and the pace and the dynamical result would both be found to remain nearly as above.

ROYAL CORNWALL POLYTECHNIC SOCIETY.

The seventh annual meeting of this Society was held on Tuesday, the 8th of Oct., in the Polytechnic Hall, Falmouth. Sir C. Lemon, Bart., M.P., in the chair. Several premiums were awarded for mechanical and scientific inventions and improvements; on some of the most important prize subjects, however, no award was made, the judges, in some cases, not considering the conditions of the offers, to have been sufficiently complied with—and, in others, that no essay or invention of sufficient merit was sent in. We extract a few notices of inventions from the report.

Preventing Corrosion of Steam-engines.—Mr. Tweedy stated that there had been two means suggested; one was similar to the means for preserving the copper sheathing of ships, by applying galvanic action. This plan was carried into effect in steam-engines, by applying zinc between the boilers. The other method suggested was an application of a mucilaginous preparation from potatoes.

Raising of Miners.—Mr. Enys read the report of the committee appointed at the last meeting, to investigate the different plans proposed for the accomplishment of this object, and to apply the subscription entrusted to them. Two plans had been proposed in committee—one, to allot the sum in premiums, for the best plans when carried into operation; and the other was to select the most favourable terms offered for erecting the machinery, by any mine suited for the purpose, and to engage to pay, on its completion, the stipulated sum out of the subscribed funds. The latter plan was adopted, and circulars were forwarded to the mines, explaining the considerations by which the committee would be guided in the selection of proposals:—

1. Depth to which the machinery was applied.
2. Efficiency and security.
3. Number of men benefitted.
4. Amount of pecuniary assistance required.
5. Period of time for its completion.

Communications had been exchanged between the committee and the agents of the Godolphin, Wheal Vor, and Fowey Consols Mines. In the two former, no suitable shaft was found. In the Fowey Consols, a whim-shaft was offered, of 180 fathoms, but the cutting of the shaft would occupy about eighteen months, by which time another shaft of 200 fathoms would be disengaged. The adventurers in the Fowey Consols proposed to erect one of two apparatuses suggested by their engineer and agents, provided the several sums subscribed should be paid to them on its completion, and in the event of the committee declining this proposal, offering to subscribe 100*l.* towards the erection of suitable machinery selected by them. Considering the time required for cutting the shaft, the committee felt it was not expedient to engage with the adventurers of Fowey Consols, which would preclude them from embracing any more favourable offer within that period. Under these circumstances, no trial had yet been made of any of the proposed plans.

Calculating the Efficiency of Steam-engines.—Professor Moseley appeared to think that the efficiency of a steam-engine could be measured only by observations of the cylinder itself, because the estimate at any other place was less than the actual deficiency on account of friction and other causes. Hence they could not tell *à priori* of what the engine was capable. If they sent a good measurement of the efficiency of the cylinder, and also of the work actually performed, they should then arrive at a true estimate of the power of the engine, and also of the loss by friction, &c., by subtracting one from the other. In the Cornish engines they had already the efficiency of the working parts; they required, therefore, only the observations at the cylinder. It was the difference of these which was the efficiency for the pit work, of so much importance to the adventurer and engineer. Professor Moseley proposed to arrive at the efficiency at the cylinder by connecting a second smaller cylinder with it of about six inches diameter, so as to allow of the steam acting upon the spring through the medium of a solid plug in the latter. The effective pressure upon this plug as indicated by the quantitatum measurement by means of the steel spring, will be always equal to that upon an equal area of the piston of the engine; so that knowing one of these pressures they could always determine the other—namely, the effective pressure. He further thought, that they not only wanted to know the effective pressure throughout the whole duration of the stroke, but also how much of the stroke was described under any given pressure. The out as well as the in stroke should be registered. There seemed but little doubt that Mr. M. had succeeded in inventing methods for arriving at the efficient power of the steam-engine. It was the mechanical details which required consideration. They must obtain very perfect springs calculated to yield through spaces proportioned to the pressures. This property could be given to spiral springs, as well as to bow springs of a given form, and with due correction for the friction of the small cylinder, the method might be made practically perfect.

Preparation of the White Oxide of Arsenic (arsenious acid) in Cornwall.—Mr. Henwood described the difficult process of separating tin from copper and iron ores, with which it was often intermixed, and stated that the sulphur and arsenic expelled in the process was for many years rejected as utterly worthless. It was thought, however, that the white oxide of arsenic might be extracted from it, and about thirty years since it was successfully effected by the late Dr. Edwards, who established a manufactory for the purpose near Perranwell, which was long the only one in the United Kingdom. Within four or five years a second had been erected near Bissoe Bridge, and a third had been more recently set at work near Redruth. The materials were now collected from the burning-houses in all parts of Cornwall, and placed in a reverberatory furnace, having a long flue, and the heat is so slowly increased as to dissipate the sulphur before the arsenic is volatilised. This was assisted by means of small fires, communicating with the flue in different parts, by which means the sulphur was carried far on in it. The temperature was then carefully raised, and arsenic was driven off; but as this required a greater heat than the sulphur, it was the more readily deposited on the sides of the flue. When this had been continued for a sufficient time, perhaps weeks, or even months, the fire was extinguished, the flue was opened, and its contents were removed. The finer and purer parts of the arsenic were found in a crystalline state, near to the fire; and as the distance from it increased it was more and more mixed with sulphur; this was again placed in the furnace for a repetition of the process. The purer portion now underwent a further process in cast-iron retorts, in order to render it fit for sale, essentially different from that adopted in Germany.

Supplying Miners with Hot Soup on their coming up from underground, in Dolcoath Mine.—In the autumn of 1837, Lady Basset suggested, whether, if the miners could be supplied with hot soup on their reaching the surface, it would not materially lessen the danger arising from a checked perspiration—at the same time offering to be at all the expense attending the fitting up a room and apparatus, and likewise of the soup itself for two months, in order to try the experiment. The paper then described the apparatus. A column of old pumps passed over a stage in the shop in connection with the stove, and served as a chimney, and also to dry the men's clothes, so that if the men were wet on coming to the mine, their clothes were quite dry on coming up from underground; and the underground clothes were dried against the next corps. The cost of 100 gallons of soup was about 25*s*., or 3*d*. per gallon, including attendance. At the earnest request of the men the agents continued the delivery from November, 1838, to the end of July, 1839. During the first season the interest taken by her ladyship was very great. She often came to see how the work proceeded, and to taste the soup. It appeared that the doctors had recommended the skimming of the fat off, but her ladyship said, "Recollect this is to be no doctor's soup; I am sure it is best with the fat, and the men will like it all the better." The result had shown her ladyship to have been quite correct, and at the end of the season she declared that she had never laid out money with greater satisfaction in her life.

Steam-boiler Safety-valve.—The plan that was now proposed was one that should give an alarm on a deficiency of water occurring. It was not one that required the constant inspection of the engineer, as the common cock did. It was first suggested by Mr. Hocking, of Copperhouse, and received the premium of the Society last year. But the plan which Mr. Hocking proposed, of attaching this alarum to the boiler, was one which it was thought would get out of order. There was a rod working through a stuffed box, which would open and shut, and a cock, both of which were likely to get out of order. The plan which Mr. Loam suggested, consisted of four copper balls, containing air; at the top of this was a small valve. As long as the water was at its proper guage these upper balls would press the valve tight, and prevent any escape of steam. As soon as the water got below the proper guage the steam wou'd pass out, and produce a hissing noise, similar to that which is heard on a railroad, and which may be heard at a distance of more than five miles.

Boring Rocks by Chemical Means.—Mr. Prideaux observed, that a year or two since it had been suggested to him whether some chemical process could not be adopted to bore hard rocks. After some consideration, and trying several experiments, he at last found that a stream of hydrogen-oxygen gas applied to a piece of granite soon produced heat, and on the application of cold water the stone became soft, and yielded to the tool. He repeated the experiment with the same result in every case. Mr. P. then explained how the gases should be mixed, and how it might be infused into the hole in the rock. He also said that a great deal of the difficulty of getting the gas at the bottom of the mines might be obviated by very simple means. Oxygen might be superseded by common air from a pair of double bellows; and the common coal gas would be found

better than hydrogen, because it contained more inflammable matter in a given space, and it might be procured from any neighbouring gas-works, and conveyed down into a mine in a copper vessel. If oxygen gas should be found absolutely necessary, nothing was easier to procure where there was a steam-engine; they had only to get a little iron retort, and in a county like Cornwall, abounding with manganese, they need never be at a loss for oxygen gas. He did not, however, suppose, in the present state of underground management in our mines, this plan would be adopted; but he was of opinion, should the Mining School be continued for two or three years, there would soon be many young men ready to carry it into effect.

RECENT AMERICAN PATENTS.

[*Selected from the Franklin Journal for August.*]

Wool Cards, *George Faber, Canton, Ohio.*—The card intended is the common hand card, and the patent is obtained for using a foundation of wood instead of leather for containing the teeth. A veneer is to be cut of a suitable thickness, and reduced to the proper length and width, and this, after being steeped in water, is to be put into the card machine, where it is to be pricked and stuck with teeth, in the same manner as leather is stuck. There is not any claim made to the machine, but only to the use of the foundation of wood.

Dressing and Finishing Leather, *Adam Hickman and Edwin L. Davenport, Abingdon, Virginia.*—The practice of finishing and dressing upper leather as at present used, is, when it is drawn from the vat, whilst wet, it is shaved, then oiled on the grain side, the grain then turned and the flesh set down with a *slecker*, then stuffed out. This is a process known to curriers as that of covering the flesh side with a composition of oil and tallow. It is then hung up to dry, and when fully dry, taken down, beaten on a pin block, then boarded up, and the flesh set down with a stone instrument. These last operations are necessary to fit the leather for whitening, or dry shaving, to remove the coating of oil and tallow so that the leather may be prepared to receive the blacking.

Our mode is this, when the leather is taken from the vat, wet, shaved, oiled on the grain side, and the flesh set down in the usual manner, it is then simply oiled on the flesh side, dried, pin blocked, boarded, and trimmed, and is then ready for blacking.

By this mode there is a considerable saving of labour; *it excludes boarding up once, and leaves the whole tedious routine and* very laborious operation of dry shaving, or, as it is commonly called, whitening, well known to all curriers as making a large amount of the labour sustained in fitting up leather for the market. The shoulder and flank are kept much thicker; this is a matter of great importance, as the whitening, &c. cannot be done without reducing the thickness of the leather, and otherwise impairing its quality where it is already deficient.

Ploughs, *Cyrus Alger, Boston, Massachusetts.*—The invention consists in the giving to the iron work of the whole body of the plough, consisting of the mould board, land-side, share, moveable, or permanent points, and other parts requiring it, that malleability which allows of their being altered in shape, in the same way in which wrought iron may be altered, and at the same time giving to all the cutting edges, and to such other parts as from their exposure to wear may require it, the necessary degree of hardness and temper, and the capability of being softened, drawn out, and again hardened and tempered, whenever it may be desired.

I cast the respective parts of the plough to be made, of iron, from any of the known patterns, and I then subject these parts to the well known process of annealling, by which cast iron is rendered malleable; having carried this process to the necessary extent, by which the iron is brought into that state in which it is susceptible of being hardened and tempered like steel. I then harden such of the cutting edges, and other operating parts, as may require it, and temper the same, in the manner in which steel is ordinarily hardened and tempered. I thus obtain a plough which, whilst it can be manufactured at but little cost, will possess all the useful properties of a plough the body of which is made of wrought iron, and its cutting edges and points, and such other parts as are most subject to wear, laid with steel.

Peck-hammer, for Pecking Mill and other Stones, *Bela Gardiner, Massachusetts.*—Peck-hammers have been made by taking two pieces of iron, each in the form of a half hammer, and securing a plate of steel between them, by means of screws or wedges; the present patent is taken for an improvement in this kind of hammer. The steel plate is to be upset at its upper end so as to form a ledge on each side. The cheeks of the hammer have several grooves along their inner sides, from front to back, to admit these ledges, and the steel plate, as it wears down, may be lowered by the aid of these grooves, and held firmly when in use. —[See a description of a chisel constructed upon this plan, and patented in England,

by a Mr. Smith, *Mech. Mag.* vol. xxviii. p. 162.]

GENERATING STEAM BY BRINGING WATER INTO CONTACT WITH HOT OR BOILING OIL, OR GREASE, *Horatio Hubbell, Philadelphia.*—This invention consists in applying to steam engines a mode of instantaneously generating steam by bringing water of the common temperature into contact with hot or boiling oil, or hot or boiling grease; the steam so generated to be applied as the moving power of the steam engine. The words "common temperature" are used as aforesaid, because water of that temperature is the kind proposed to be used, is fully adequate to the effects designed, and is most economical; but at the same time the effect can be produced as long as the water is inferior in temperature to oil, the oil being heated above the boiling point of water, or up to that point. The boiling point of oil or grease being above that of water, or, *vice versa*, that of water being below that of oil or grease, by bringing water in contact with oil or grease heated above the boiling point of water, steam is instantaneously generated. The point to which the oil or grease is intended to be kept heated is at, or near, the boiling point of oil, since the hotter the oil the more rapid and complete the action upon the water. The oil (whale oil is perhaps most convenient and best,) is to be introduced into copper, brass, or other suitable steam-tight metallic cylinders, boilers, generators, or vessels. The quantity of oil to be introduced is to be regulated by the capacity of the cylinders, &c., the bottom of which it ought to cover to some depth, so as to have a good body of oil; generally, filling about a fourth of the cylinder, &c., will be sufficient, though there may be more. The oil may be introduced into the cylinder by means of a stop cock with a funnel head, the cock being placed or inserted at the side of the cylinder, so as to be on a level with the upper surface of the oil. The oil so introduced having been heated above the boiling point of water by a fire conveniently applied to said cylinder, boiler, generator, or other suitable vessel, so as to gradually fall upon the surface of the oil, or so as to come into contact with the oil at or beneath its surface. The reservoir here spoken of, is intended, in general, to be a large basin placed on a level with the top of the cylinder, &c., the pipe passing from the basin to the cylinder.

The said pipe or pipes to let water into the cylinder are to be provided with one or more valves, shutting outwards, so as to prevent the steam after it is generated, from *escaping through them*, while by opening *inwards they admit the water*. The bore or caliber of the pipe or pipes may be so contracted as to let the water into the oil continuously, but very slowly and gradually, or the pipe being more free in its bore may have its water let into the oil, or shut out, by means of a cock constructed so as to open and shut at alternate intervals, by means of an eccentric, and the working of the engine; or the said pipe or pipes may be connected with pumps such as are now used to force the water into common boilers; but still care must be taken so to construct them as to introduce the water gradually, and by measure, to the hot or boiling oil, as is done in the former cases. The quantity of water to be let into the hot or boiling oil is to be regulated by the quantity of oil employed, and the extent of its surface, and the necessity of generating a greater or less quantity of steam, care being always taken not to drown the oil by throwing in too profuse a quantity of water upon it, and thereby produce a dangerous explosion. The pipes aforesaid may pass directly through the sides of the cylinder, &c., to the oil, or entering at the top may be carried down from the top of the cylinder, &c., along the inside of the cylinder till it reaches the oil.

The heat of the oil in the cylinder may be ascertained and regulated by the application of the thermometer, to a hollow, bulbed, or funnel-headed stop cock inserted in the side of the generating vessel, so as to let a quantity of the heated oil pass out at any time into the funnel head; this cock may be also used for introducing the oil. The oil may be drawn off from the generating vessel by means of a stop cock inserted in the bottom.

As the steam is thus generated, it is applied to, and let off from, a piston working in a steam-tight cylinder by means of the sliding valve worked by an eccentric, as is now done in high pressure steam engines.

In the foregoing specification, I claim as my own invention and discovery, the application to the steam engine, of the mode of instantaneously generating steam by bringing water of the common temperature in contact with hot or boiling oil, or hot or boiling grease.

Remarks.—We have not inserted the foregoing specification with the expectation of making known a valuable improvement in the generating of steam, but as a sample of those hypothetical contrivances which are not unfrequently made the subjects of patents by persons of speculative ingenuity, but who are not under the guidance either of correct theoretical knowledge of, or of a practical acquaintance with, the subject upon which they speculate; the possession of either of these would, we are well assured, have arrested the foregoing. We are not informed by the patentee what benefit he

anticipates from his invention; it certainly could not have been security from explosion, where water and boiling oil are to be brought into contact, and where it is proposed to introduce the former under the surface of the latter. If the inventor had manipulated with boiling oil, he would have been aware of the danger arising from the contact of water with it. It would be scarcely possible to find two substances more ready to quarrel together, and to become involved in a dangerous broil, if brought into intimate connexion; besides, were there no danger resulting from their contact, oil would be one of the least suitable articles that could be chosen for transferring its heat rapidly to water, as it is a bad conductor of heat, while such a transfer would require a very good one. In case of fire, and but few articles are better calculated to produce this than boiling oil, the whole contents of the boiler would administer, most energetically, to its destructive effects; gunpowder would be something worse, but not a great deal.

The specification is throughout extremely indefinite; every thing in it, except the using of heated oil or grease, being contingent, and no one practical mode of carrying the matter into operation being presented. In the present case, this is a thing of little importance, as the plan never will be adopted by any sane engineer, and the fact is mentioned merely to remind applicants for patents, of the necessity, in all cases, of presenting their inventions in such a form as shall enable any skilful workmen to carry the plan into operation.

Mode of preserving Timber, *Samuel Ringgold, of Florida, and Edward Earle, of Savannah.*—This invention consists in applying heat, by boiling in strong lime water, to the interior as well as to the exterior of timber, according to the size and kind of timber, and the use in which it is to be employed may admit, or require, for the destruction and prevention of worms in it, and for the correction or removal of the corruptible sap, and the occupation of its place by a preservative substance.

First bore the timber, if it be of a size sufficient to admit of it, through the centre, making the perforation of a caliber proportioned to the size of the piece, say from half an inch to an inch and a half, or two inches. Then boil it in strong lime water for a length of time proportioned to its size, as four to six hours, if it be twelve inches square, and so in proportion to its substance; and when the timber has had the heat and fluid conveyed through its whole substance, it is to be removed to a shed, where, protected from the *sun and wind, it may gradually dry. Finally, before it is used, the perforation* through the centre is to be completely filled with dry lime, or with petroleum, or coal tar, as the purpose for which it is intended may make preferable, and plugged by wood of the same kind, and prepared in the same manner. Also, if the use to which the timber is destined be such as to admit of it, the exterior may be payed, or coated with hot petroleum, or coal tar.

Remarks.—The plan of impregnating timber with lime, by soaking it in lime water, is quite old, but we have never yet seen any evidence of its utility. This is an assumed effect, but one which, we believe, yet remains to be proved. The only substantial difference in the plan above proposed, and that formerly essayed, is in the boiling process, and this we think of very doubtful utility. Timber may be rapidly seasoned by boiling, the moisture within it being converted into vapour, and, consequently, escaping through the pores, a condition not the most favourable to the entrance of a solution; the allowing it to cool in and with the liquor might probably promote saturation. There is another fact of some importance in the process, provided the thing itself is of any value, namely, that the colder the water the greater is the quantity of lime held in solution, and of course more would enter the pores in a cold than in a heated vessel. It is not worth while, however, to extend our speculations upon the best mode of getting the lime in until we have ascertained the fact that when it is there it will produce some good result.

Preparing Corn Husks, so as to be a suitable Base for Paper and Oxalic Acid, *Homer Holland, Westfield, Massachusetts.*—The corn husk consists of two distinct substances, viz.: lignia and mucilage. The lignia, or fibrous portion, is similar to the fibrous portion of hemp or flax, and must be completely freed from the mucilage before it can be bleached. By making it susceptible of perfect bleaching, without destroying the strength of the fibre, it may be used for valuable purposes.

The nature of the invention consists in making the mucilaginous portion of the husks soft and soluble by means of alkaline solutions, so as to be readily removed by washing and beating, leaving the fibre strong and capable of being perfectly bleached.

The husks, properly selected and cleaned, are to be macerated for several hours in a moderate solution of carbonated alkali, in any convenient kettle, caldron, tub, or vat, which may be kept warm by fuel or steam. After having been thus macerated, sufficient of hydrate of lime is to be added to combine with the carbonic acid of the alkali, and render it caustic, so as to dissolve the mucilage, and the whole is to be boiled from one

to two hours. The mucilage of the husk is thus converted into a soluble umate of the alkalies employed, and in this state may be removed from the lignia or fibre, by washing in several waters, rubbing, and scouring. If the husk be thus treated the lignia is strong, and if the washing, beating, and scouring be suitable, the fibre may be completely separated, and may be perfectly bleached by an alkaline chloride, or sesqui-chloride, in solution, or by any of the known and appropriate processes of bleaching. The lignia or fibre, thus prepared, may be used as a substitute for sugar or starch in making oxalic acid, and after being rendered even, if necessary, by rolling or pressing, may be manufactured into paper in the same manner as the ordinary fibre from rags.

Remarks.—The only novelty in the process above described, is that of rendering the alkali caustic, by the application of quick lime, after the husks have been macerated; the other steps have all been taken in the manufacturing of paper from straw, and other materials; to what extent this part of the process is of utility is a practical question, concerning which we are not informed; all we know respecting it is, that it is in the hands of a gentleman of much skill and experience, and who had, therefore, undoubtedly satisfied himself of the utility of the plan before presenting it for a patent.

GRAVEL PUMP, *Laura Rice, Salina, New York.*—"This pump, or machine, is inserted in a well, or shaft, which should be properly tubed with cast or sheet iron, or other proper material, with space to permit it to pass readily, and having a rope, or cords, connected with the end of the piston, is worked in the manner of a pump until sufficiently charged with the substance to be removed, when it is raised by a windlass, or other power. It is particularly adapted to the excavations of shafts for brine, and was discovered whilst excavating wells for that purpose, as no instrument was known which would readily raise the gravel from the beds without great delay and difficulty, and at the same time leave the sides of the well bare and pervious to the transmission of brine, the ordinary process of drilling merely crowding the staves from the shaft, and rendering the sides of the well compact, hard, and nearly excluding the passage of small streams of brine into the well."

The form of the exterior of the machine is that of two cylinders differing in size, the smaller standing above the larger; the lower cylinder is to be about 11 or 12 inches in diameter, and twenty-one in height; the upper one may be eight inches and a half in diameter, and fifteen in height; they are connected by an offset, are hollow, and made of cast iron; the upper cylinder forms a pump chamber in which a piston is to work. The lower cylinder constitutes a receiver to retain the sand and gravel drawn into it by the action of the pump. In the bottom of the lower cylinder there is a round opening of six inches in diameter, and the upper and inner edge of this opening is surrounded by pieces of whalebone, or other elastic material, which rise from it so as to form a cone somewhat like that of the pointed converging wires in some rat-traps; these may be six or seven inches long. They allow of the passage of stones and gravel into the chamber, and prevent their return. This elastic material is surrounded by a sleeve of cloth, which admits sand to pass up and around it.

The claim is "to the manner of connecting and combining the respective parts of the above described machine, for the purpose of excavating wells and shafts, and the removal of sand and gravel therefrom; that is to say, the combination of the exhausting apparatus with the cylinder, the conical bars of whalebone or other material, and the canvas surrounding the same, constructed and operating in the manner set forth."

GURNEY'S BUDE LIGHT.—LIGHTING THE HOUSE OF COMMONS.

From the "Minutes of Evidence taken before the Select Committee" upon lighting the House of Commons, we gather the following particulars upon the subject of Mr. Gurney's "Bude Light," which has obtained this name, the inventor states, from his residence at that place, in Cornwall. It was so denominated at the Trinity House by way of distinction, Mr. Gurney's name having been previously associated with the "Lime light," which he published in 1823. The evidence of Mr. Faraday, Drs. Arnott, and Lardner, Sir David Brewster, and others, was very strongly in favour of the invention, and the Committee reported to the House that—

The result of their examinations has been to satisfy Your Committee that no danger would be caused by the adoption of the proposed method of lighting the House; and that any quantity of steady light, that can reasonably be required, may be obtained from it with certainty and regularity, and at an expense not exceeding the present expense of lighting the House by wax candles. By this method of lighting the lamps are entirely insulated from the body of the House, so that the warming and ventilating of the House are not interfered with.

Your Committee are, however, of opinion, that the mode of placing and applying the light is susceptible of improvement; and,

under these circumstances, they recommend that Mr. Gurney be directed to make further experiments as to the best mode of arranging and distributing the light; and that these experiments be carried on during the recess, under the directions of the Treasury.

In consequence of this recommendation Mr. Gurney is now, in conjunction with Dr. Reid, engaged in carrying the new plan of illumination into effect, and at the commencement of the next session of Parliament the invention will, we doubt not, be put to a fair and practical test.

Although we have already put our readers in possession of the principles and some details of the plan in our report of Professor Faraday's Lecture on the subject at the Royal Institution in February last, (Vol. xxx. p. 398), we trust that, notwithstanding there may be somewhat of repetition in the following digest of the evidence, it will be found interesting, and mayhap valuable to many of our readers.

Mr. Gurney stated, that his oxy-oil, or Bude light, was produced by means of a common Argand lamp with cotton and oil, through or inside the flame of which a stream of oxygen is passed, in place of atmospheric air, as in ordinary lamps. The oxygen strikes the nascent carbon and vapour of oil, or carburetted hydrogen, as it is distilled, and produces by their combustion an intense light.

The result of experiments made at the Trinity House with a view to ascertain the quantity, intensity, comparative expense, practicability, and certainty of duration of the light is as follows. First, as regards quantity, or intensity of light,—Taking the flame of an Argand burner at seven-eighths of an inch in diameter, burnt with atmospheric air, as a standard, a Bude light of one quarter of an inch diameter produces a light equal to two such Argand burners. About five wax lights are equal to a seven-eighths of an inch Argand lamp. The experiments were made by the photometer, that is, by the comparative intensity of the shadows produced. No exact law of increment of the light has yet been arrived at, but many singular results have followed the experiments; one is, that the flame is not fully transparent, but occasions loss of radiation from the opposite flame, by which the quantity issuing from a certain sized flame is much modified by the curve; but in practice, the light may be said to increase as the diameters of the flame.

Second, as regards comparative expense. The cost of the Bude light as compared with the Argand burner is greater, in the proportion of 13 to 12; *as compared with wax lights at 1s. 9d. per pound, it is about* half the expense. The quantity of oil burned is about one-fourth that consumed by the Argand lamps, which is about a pint in 12 hours.

The oxygen gas for the supply of the lights can easily be produced by the dry distillation of manganese in iron retorts. An inexhaustible supply of manganese can be obtained from the mines in Devonshire, Cornwall, Warwickshire, and Cumberland. Taking the present price at from 8*l*. to 9*l*. per ton, the wear and tear of the apparatus, the expense of fuel and attendance, the oxygen gas may be said to cost about 2*d*. per cubic foot. This expense might possibly be reduced, as the roasted manganese may be used in the arts, and possibly for bleaching purposes, in a different way from that in which it is at present used. It might be supplied in London at 6*l*. or 6*l*. 10*s*. per ton, but the price depends a good deal upon the quality; some ores are purer than others; some give 73 per cent of the manganese, others not so much. Oxygen may also be obtained from the nitrate of potash, but not so cheaply nor so practicably as from manganese.

The expense of the apparatus necessary to produce oxygen sufficient to supply Bude lights for the House of Commons would be, for retorts and gasometers, about 100*l*., and for brickwork, setting the retorts, &c., about 20*l*. This apparatus would produce 130 feet an hour. A burner of two eighths of an inch diameter would consume rather less than half a foot per hour, and there being 60 burners, 30 feet per hour would be all that was necessary. There is no difficulty in managing and preparing the gas, or lighting and superintending the burners. There is no possibility of explosion; there is nothing to explode. "When you can inflame oxygen, you may set the Thames on fire; one is just as inflammable as the other."

The length of time the Bude light will continue burning without the necessity of trimming the wick, depends uppn the nature of the oil; if it be good sperm oil it will run six hours without trimming; the carbonaceous matter which accumulates on the burner has merely to be brushed off.

Professor Faraday's evidence agreed in the main with that given by Mr. Gurney. The experiments he had made had extended over 7 months. He stated that the light burned with great steadiness for eight hours; required trimming every four or five hours; was easily managed; there is no danger but from the great heat, and this can be guarded against by carrying off the hot air from the burner. There may either be one cistern of oil to supply a number of burners, or each burner have its own cistern. The lamp ex-

perimented on at the Trinity House had one cistern in the centre, which supplied the burners arranged round it. Any gas that might escape would not be deleterious, but the contrary.

The comparative expense of this light and the Argand, including every thing but the attendants wages, would be for the Argand 8¼*d.*, and 10½*d.* for the Bude.

With regard to this estimate of Mr. Faraday's, Mr. Gurney explained that it was given from experiments made six months previously, when the light was not so perfect. The consumption of oil was greater, consequently the expense was greater, and in the ratio of 8½ to 10½. Since that time further experiments had been made, and the relative expense reduced to the proportion of 12 to 13. The expense has still further been reduced, and it may now be said to be lower than the Argand.

The particulars of the experiments made by Mr. Faraday are contained in the following papers, which were delivered to the Committee.

Letter from Professor Faraday to Joseph Hume, Esq., M.P.

Royal Institution, 4 June, 1839.

Sir,—On receiving the candles and your note, I hastened the experiments, and now give you the results, begging you to bear in mind, that it is only from the average of many experiments that a correct mean can be deduced. I am satisfied that the results I send you are not far from the truth.

A certain amount of light used as a standard in the investigation of the Bude lamp cost, when obtained from an Argand lamp burning in the usual way, 8¼*d.* for 12 hours, the oil being at 6*s.* 8*d.* per gallon.

An equal amount of light for the same time, obtained by the Bude lamp, supplied with the same oil, cost 10½*d.*, with all expenses, except that of attendants' wages.

An equal amount of light from the candle (three to the pound), requires 5·32 such candles, and would consume in the 12 hours 1·2335 lb.; which, at 1*s.* 9*d.* per lb., would cost 26*d.* nearly.

An equal amount of light from the candle (four to the pound), requires about 6·94 such candles, and would consume in the 12 hours 1·43 lb.; which, at 1*s.* 9*d.* per lb., would cost 30*d.* nearly.

Taking the average of the two candle experiments as the best expression of cost at present, then that light which costs in the Argand lamp.................. 8¼*d.*

Will cost in the Bude lamp.... 10½*d.*

And will cost in sperm candles.. 28*d.*

I remain, &c.

(Signed) M. FARADAY.

Extract from Mr. Faraday's Report to the Corporation of Trinity House, dated 29th October, 1838.

I was anxious, before forming a final conclusion respecting this lamp, and its relation to the Argand and French lamp in light and expense, to re-examine the consumption of oil of the two latter. The Argand light has been used as the general standard; but without especial care it is not possible to have the lamp burning with the same intensity at different times, and therefore I made some final experiments for the purpose of greater accuracy in this respect. The French lamp, also, I have heretofore taken, both as to light and expense, upon the report of Lieutenant Drummond; and accordingly thought fit to re-examine and compare it afresh.

The Argand Standard Lamp was brought into good condition, and its flame not only measured, but drawn on a scale, so that at other times it could be adjusted until it possessed, as nearly as possible, the same power. I then ascertained for myself how much oil was burnt by it in 12 hours, keeping the flame during the whole time at the standard height, and found it to be 0·8 of a pint of oil, which, at 6*s.* 10*d.* per gallon, would cost 8·2*d.*

Gurney's Good Lamp. On two occasions, namely, the 8th and 18th of October, this and the Argand lamp, in the state just described, were compared; the mean result was, that the light equal to one Argand, consuming the given proportion of oil for 12 hours, when obtained by the Good lamp, cost 10·42*d.*

French Lamp. This lamp, being put into action and lighted, was brought into what I and Mr. Hall supposed to be a very good condition, after which attention was given to keep it in that state. Whilst so burning, it was found to give a light equal to 9·68 Argands, supplied with the given proportion of oil, namely, 0·8 of a pint in 12 hours. The consumption of oil to produce this effect in the French lamp was found to be at the rate of 14·4 pints for 12 hours. Thus, the light of 9·68 Argands, for 12 hours, costs by it 12*s.* 3½*d.*; or the light of one Argand for the same time, 15·25*d.*

According to these results, therefore, light equal to one Argand costs in the Argand lamp .... 8·25*d.*

Good Gurney lamp .... 10·40*d.*

French lamp .... 15·25*d.*

The three being as closely compared as they could be in so few experiments.

Whilst burning with these proportions of oil and oxygen, I compared the Good Gurney and French lamps together, in their

power of illumination, and found the former to be as 2·52, the latter being unity or 1. This was on the 18th October, when the former was burning only 0·92 of a pint of oil per hour, and the latter was consuming as much as 1·20 pint in the same time. The Gurney lamp was very steady in its light, but the French lamp I found liable to frequent variation, and often requiring adjustment to prevent the diminution of the light or the smoking of the flame.

Whether I consider the general comparative results obtained during all the trials, and referred to in the various reports given in, or whether I take only those in which I more strictly compared the Argand, French, and Good Gurney lamps, still I am bound to recommend the latter to the favourable consideration of the Honourable Board. The two great points upon which I base this recommendation are, first, the price of the light obtained by the use of the lamp, it not much exceeding the price of the light obtained by the use of the common Argand; and second, the facility with which a steady regular intense light can be obtained and preserved in order for many hours together.

There are also other points of recommendation; and what may prove a great one is, the variation which the construction of the lamp allows, consisting as it does of constituent burners; these may be used singly or in association, and so a light procured at the same relative price, but varying from that of 1½ Argand to 40 or 50; the highest proportion being compressed into a space not more than 3½ inches diameter. This facility of variation gives the power of using the light either with reflectors or refractors, at pleasure; and combined with the relative price of the light must be of great importance.

Unless I have made some great mistake, the advantage, as compared with the French lamp, is very great. The combustion of oil in the French lamp is, as might be expected, very different at different times, but of course its light will be different also, if the oil in all cases be equally well burnt. Taking the returns from the lamp at the Menai, for the month of July, 1838, the average consumption is at the rate of 10·524 pints for 12 hours. The returns for the said month of the lamp at the Start Point is 12·24 pints for 12 hours.

My result, when I burnt the lamp at its best, and endeavoured to compare it strictly with an Argand, was 14·4 pints per 12 hours; it then gave the light of about 9·68 Argands, consuming each 0·8 of a pint per 12 hours; i. e., it consumed 18 times the oil, and produced not quite 10 times the light. Lieutenant *Drummond gives the consumption of* the French lamp still higher, 16·6 pints of oil in 12 hours, it then producing the light of 9·75 Argands, burning 1·0625 pint in the same time; so that the oil being 16 fold, the light was only 9¾ fold. It is not therefore merely from the direct comparison of the French with the Good Gurney light, but the comparison of both these with Argand lamps, burnt by myself and others at various times, that the following conclusions may be drawn; namely, that for the same money, the Good lamp will produce from one and a half to almost twice as much light as the French lamp, in the same or even in a less space.

Added to the previous recommendation of the Good lamp, are those which may fairly be drawn from expectation of improvement in the preparation of the oxygen, and the use of cheaper oils or fuels. I have, in a former report, expressed my strong opinion, that when the oxygen is made daily, the wear and tear of the retort will be less, and the consumption of fuel much diminished.

I also think it probable, that the manganese used will still find a price, though a low one, in the market; and that these and other circumstances will importantly diminish the cost of the oxygen, or that substance the use of which in the Good lamp makes two-thirds of the whole expense. With respect to the lamp and fuel, it is exceedingly likely, that with the employment of the tripper or finger already described in the lamp No. 5. to remove such carbon cones as may be formed, cheaper fluid fuels than the oil as yet used may be burnt; and thus a diminution of expense be effected in that direction also.

The evidence of Mr. Gurney and of Mr. Faraday, of which we have now given an analysis, contains the most important part of the information elicited by the committee. Many important and ingenious suggestions were thrown out by the other witnesses, for the publication of which we have not room, but they are mostly mentioned and fairly commented upon by Mr. Gurney in the following review of the whole evidence:—

Perhaps it may not be out of place here for me to state the circumstances which led to a trial of the oleo-oxygenous, or Bude light, in the House of Commons. In 1834, a committee of this House was appointed to inquire into the subject of lighthouse management and lighthouse illumination generally; the evidence before that committee was important, connected with artificial light, as well as with the maritime interests of the country. Mr. Hume, the chairman of that committee, was pleased to mention my name to the Trinity House as a fit person to carry out the experiments recommended in the report of that committee with regard to the "Lime light;"

an account of which I first published, and suggested as possibly applicable for lighthouse purposes, in the year 1823, in my lectures on the elements of chemical science, and of which an extract is printed in that report. It appeared in the evidence before the committee, that Lieutenant Drummond, in 1827, used the lime light with considerable practical advantage in the survey of Ireland. I was engaged by the Trinity House to bring this question to a practical issue. I found that although the lime light was one of great intensity, it had in practice some objections; I looked for another more practicable and, if possible, equally powerful light to obtain the end we had in view, and was fortunate enough to be able by simple means to apply oxygen to the flame of oil so as to effect the conditions required. The nature of this light is set forth in the report of Mr. Faraday, made to the Trinity House, I believe, last year. There seems no doubt, judging from practical experience on the subject, that it will be found one of considerable maritime importance, both in this country and in others, and may profitably be applied to domestic purposes. It having been mentioned that this light might be used with advantage for lighting the House of Commons, I called upon Mr. Hume, the chairman of the lighthouse committee, and stated the circumstance to him. He proposed to examine the light at the Trinity House, and to bring other members with him to see it in its then more perfect form and operation; and a day was appointed, when the late Speaker, Mr. Milne, one of the Commissioners of Woods and Forests, and some other gentlemen, attended at the Trinity House, who expressed a favourable opinion of the power of the light for the House of Commons. As I was myself confident, and unwilling to put the House to any expense upon what might be considered a theoretical experiment, I offered to make the trial at my own risk and expense, upon certain conditions; and my proposition was accordingly laid before the Chancellor of the Exchequer in writing. He objected to that mode of conducting the experiment, as admitting the conditions, which he preferred leaving to the consideration of the House; but offered to sanction a preliminary outlay of not exceeding 100*l.*, which I had stated would be sufficient to cover the actual cost of the experiment, to show its power and applicability. I fitted up the apparatus for the experiment, confining it to the point of power, leaving its diffusion, softening, and other practical details to the judgment and opinion of the House, or to scientific men more acquainted with that branch of the subject than myself. I may here be allowed to state that I have had no personal object beyond that of the credit and satisfaction I should feel in effecting a more wholesome and comfortable mode of lighting the House. The light belongs to the Honourable Elder Brethren of the Trinity House, who have allowed me to make any use of it for the public advantage; they liberally met the subject of investigation from the beginning, furnished every facility for carrying it to its termination, and paid all the expenses of the long series of experiments. These are the circumstances connected with its introduction into the House beyond what will be found elsewhere. I beg now to state the conditions for better lighting the House of Commons, which appeared to me essential. They seemed to be, first, that the light should be free from danger; secondly, that it should be applicable in the hands of ordinary men; thirdly, of sufficient power when placed out of the House to illuminate it for all business purposes; fourthly, that it should not exceed the present expense of wax lights; fifthly, that all heat should be insulated, so as not to affect the atmosphere of the House, or its ventilation; sixthly, that the illumination should be powerful, but not fall offensively upon the axis of vision, or fatigue or irritate the retina. Having been permitted to be present in the committee during the inquiry, I have observed that on the questions of superior applicability and safety, all the scientific men agree; but I would call the attention of the committee more particularly on these points to the evidence of Mr. Faraday, because he has been officially employed to investigate it by the Elder Brethren of the Trinity House, by actual experiment upon every point connected with these heads, because this investigation involved the question of life and destruction of property to a fearful extent, connected with the maritime affairs of this country; which considerations must have induced, and did induce, him to submit it to the most rigid and minute inquiry. I also refer to his testimony, more particularly upon the head of expense, because he was also officially employed to determine by actual experiment every direct and indirect expense connected with the practical use of the light. Upon the subject of power and intensity, I also particularly refer to Mr. Faraday's evidence, because he has made extensive experiments to measure and ascertain it accurately for a great national object, and repeated his trials again and again, on account of the correct official report he was called upon to make to the Trinity House. All the witnesses also agree that the heat which may arise from the burning of the light is entirely insulated from the House; and also, that the purity of

the atmosphere is not affected by the Bude light, and that it is kept separate from the system of ventilating the House. They all agree that the light may be kept out of the axis of vision, and modified, distributed, and softened to any extent by simple means; but the means are proposed differently by different persons; and this seems to be the only question upon which they differ. The known laws of science appertaining to quantities, intensity, radiation, and many other properties of light, are accurately known, and sufficiently so to enable scientific men to determine the points upon which they all agree; but when we come to practical diffusion the laws are not so well known: on the practical diffusion for domestic purposes, I conceive, that if double the number of scientific men were examined, they would possibly give double the number of suggestions. The practical catoptric distribution of light (I use the term to mean the reflectors rather than reflected light) is not well known or studied by men of general science; it has, however, engaged the attention occasionally of the first scientific authorities in this and other countries. This object of science is almost exclusively confined to the attention of those engaged in lighthouse illumination; it is, however, a most important study, and in consequence of the express attention of scientific men of late years to it, great improvements have been made, some of which may be carried with advantage into domestic purposes. In the present case of the House of Commons, the application of some of these principles are most important, for they enable us to fulfil some of the most desirable conditions of the problem; for instance, that of placing the light out of the House. There is no practical way of doing this but by catoptric means. If a light be placed out of the axis of vision in the House of Commons, a condition much to be desired, it must be so situated as to produce an angle of about 40 degrees with the floor, and must be hung at twice the height at which the present chandeliers are now suspended. Light decreasing as the squares of the distances, shows that this position would entail the necessity of four times the number of wax lights without catoptric arrangement; and I would here suggest the practical impossibility of using wax, oil, or other lights, to meet this important condition. Let us suppose wax lights were to be so employed: the three chandeliers now used, containing 240 candles, are placed 12 feet 6 inches or 13 feet from the floor of the House, and they radiate a given quantity of light; if the chandeliers were placed 24 feet or 26 feet from the floor (which is the distance they must be placed to be out of the *axis of vision*) it would require 960 candles to give the same light. That number could not be burnt in the House on account of the heat, their position, and other self-evident causes; the same objections apply to oil, and also to gas light, and possibly accounts for the practical failure of the latter when tried in the House last session. To place wax, oil, or gas light in catoptric instruments for domestic purposes is very difficult, if not impracticable. These facts I beg to call the serious attention of the committee to, because they are the great points upon which the superiority of the Bude light rests for lighting the House of Commons. The eminent catoptric property of the Bude light seems to have escaped the notice of most of the witnesses, and possibly accounts for their differing in many points on the question of diffusing and tempering light. It does not seem to be recollected, that the Bude light, if placed at one end of the House, may be made to send all its illuminating powers to the other end, and produce the same effect as if it had been there placed, and yet lose nothing practically by such distance. On the subject of the diffusion and softening of light, some recommend ground glass as a medium for softening, others do not consider any media at all necessary. Dr. Arnott recommends ground glass; Mr. Barry also advises ground glass; Sir David Brewster recommends one light, which should be exposed, and objects to ground glass entirely; Dr. Ure advises the sloping glass roofs to be illuminated, and all the glass ground; Professor Wheatstone recommends exposed direct light, but seems to do so on the score of economy, supposing always the light is out of the angle of vision; Dr. Lardner objects to ground glass, and recommends a number of lights; Mr. Rixon recommends ground glass; and Sir George Cayley recommends ground glass upon the lower half of the globe which he proposes, and to pass the light through plain glass above it. This question is more one of individual opinion and feeling than of scientific research; and being sensibly aware of the difference of opinion that would exist, I only took upon myself, in my experiment, to show the power of the Bude light, and its capability of insulation, so as to meet the great conditions of the problem, and estimated its expense only for this object. On the question of ground glass, my individual opinion is that it would be more agreeable to the majority of members to use it, than to pass the light through plain glass; it certainly would effectually reduce the sharpness of the light by its refraction, so as not to offend or fatigue the retina. Though the source of light should be placed out of the ordinary axis of vision, occasionally upon change of

position, it will fall upon the eye, and in such cases the naked concentrated light would be offensive to those whose eyes were delicate. Whatever may be the scientific objections, upon physiological grounds, to ground glass, it could do no harm, because it would be placed out of the axis of vision. The question, therefore, seems to be one of comparative nightly expense, namely, the difference in the expense of that extra quantity required to pass through ground glass, over and above that required to pass through plain glass, to produce the same illumination in the House. This consideration is of little importance when placed against that of the comfort and convenience of the House, and against the expense of wax; I should therefore advise the use of ground glass. There is another question which seems to have entirely escaped notice, viz., the ratio of loss upon the quantity of surface of different ground glass; and this is one of considerable importance in our present inquiry, because it must determine the kind and size of the ground glass media to be employed; in other words, the superficial area of refracting surface most agreeable and profitable. I believe this question has never been raised, and possibly because scientific men have never directed their attention to the practical application of light for common illuminating purposes. That I may make myself better understood, let us suppose a given intensity of light to be surrounded by the superficies of a cube of ground glass of three inches diameter, equal to 54 superficial inches, a certain quantity would be lost, and a certain diffusion and refraction obtained. Suppose we surround the same light with a ground glass cube of six inches diameter, the refracting surface will be increased to 216 inches, or four times, reducing the intensity or sharpness in that proportion; the loss of light will be in some given ratio; what that ratio is remains for experiment, and certainly highly interesting the inquiry would be. The question before us is, how far, profitably and practically, we ought to extend our refracting surface, so as to make the light agreeable to the majority of members, with the least possible loss. From my experiments and observations, I should say that a centre light equal to 16 standard Argand lamps cannot have less than 128 inches, or say a superficial foot of refracting medium on every side, or six feet in all, to render it suitable and agreeable to the eye, and on this we may calculate in higher numbers. On the subject of heat from the Bude light, I wish to observe, from my experiments, that I find the quantity of sensible *heat is quoad* the quantity of combustible *matter burned in a given time*; but that the quantity of light is in direct proportion to the intensity of that combustion. The heat from a given quantity of wax or oil is the same whether burned with pure oxygen or common air; but the light is increased more than four-fold by pure oxygen; thus the heat of the Bude light is less by more than three-fourths of that given by wax or oil; and five-sixths less than that from London coal gas, which contains a larger proportion of hydrogen. Taking every consideration into account that I have stated, and others of smaller importance, which I do not think it worth while to trouble the committee by stating, but which, as a whole, have some weight; and considering all the circumstances of the problem of profitably and advantageously lighting the House, I see no reason to change my original proposition, namely, to have two sources of light to be distributed by catoptric means, through ground glass, to such angles, to such situations, and in such quantity as shall be usefully required. The same angle that will illuminate the features of members sufficiently to be identified by the Speaker, without falling directly or offensively upon the axis of the eye, will illuminate the under parts of the galleries. I submit whether it would not be desirable that some portion of the House, near the table, should not have a more softened light for the comfort of those who wish to hear, but have no occasion to read, or, possibly, write, and yet to be sufficiently near the Speaker to hear everything that is said; if so, the back seats under the gallery, near the table, I conceive most fitted for such a purpose; but this is a question not for me to determine: I beg to state, that the light from above may be thrown with equal or more power under the galleries than in any other parts of the House, if such should be desired, or *vice versâ*. In respect of the Reporters' gallery, the quantity of light these gentlemen require to enable them to take notes with the greatest ease and satisfaction to themselves, I have obtained by actual experiment when they were present, and measured it by a photometer. It is equal to the light given by a standard Argand at a distance of 20 inches. This being the settled quantity, it can always be obtained, and preserved; and if the House or the committee would state the exact quantity of light they required in different parts of the House, and express it by the same standard and determine it by the same means the reporters have done, I would undertake to give the determined quantity with great accuracy; and which would be very desirable, for, among so many members, there must always be a difference of opinion as to whether there is too little or

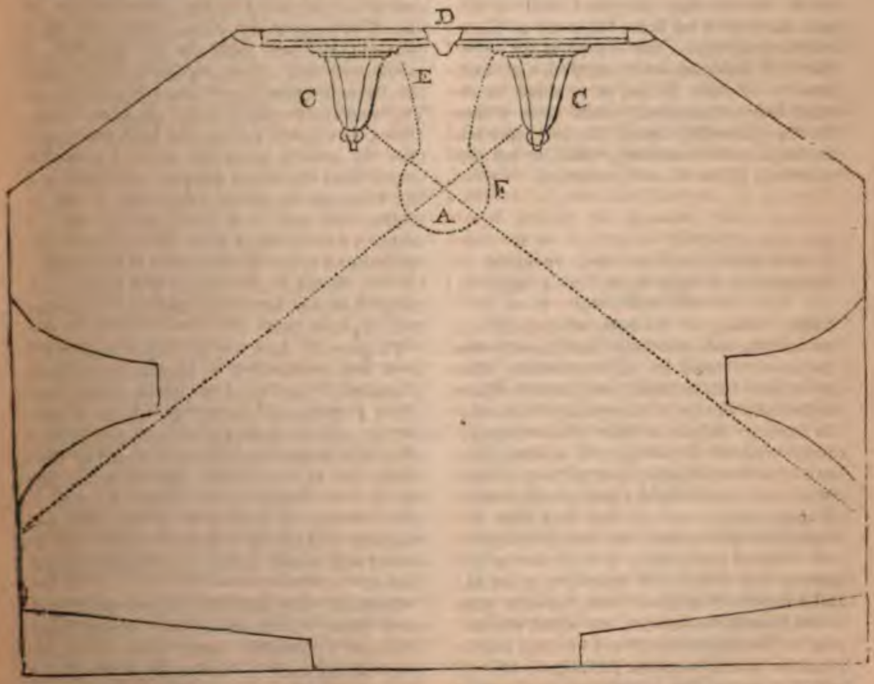
too much light: it would be exceedingly desirable to fix upon some standard of quantity. The Bude light, from its facilities of diffusion, is capable of fulfilling all the conditions I have stated.

Will you explain in what manner the experiment was made to satisfy the reporters in the gallery, and in what way you propose the experiment should be made to obtain the same information with regard to the House? —The light was first produced stronger than was necessary, and reduced gradually, until by general consent it was thought to be sufficiently low. It was then reduced too low, and gradually brought up when the same point was ascertained.

What do you mean by lowering the light? —Reducing the quantity of light, which can be done at pleasure; not altering the position of the burner. In reference to the previous question, when the light was decided to be that which was most agreeable, it was measured; the quantity of light determined by the reporters as being the best for their purpose, was equal to the light given by the standard Argand, at a distance of 20 inches. This quantity, of course, can always be obtained with great accuracy.

Will you explain how you would do it with regard to the House?—In the House of Commons I would ascertain the quantity of light, which by general consent should be thought desirable; then measure it, and take care that that quantity should always be preserved in different parts of the House. This may be done by using a standard Argand burner alone, fix it at a given distance to light a given point, and then measure that distance accurately.

Then, after the deliberate consideration which you have given to the evidence taken before this committee, what is the plan you would now recommend to be tried by way of experiment?—I think it desirable, as the experiment would be very inexpensive, to try the effect of passing the light through white linen cloth or calico stretched across under the ceiling, to ascertain its loss and diffusion, with the present light. After its power is determined, if not found in practice to be advantageous, I would then recommend ground-glass pendants to be suspended from the ceiling in the way shown by the diagram which I now produce.



Have you tried that experiment, *of passing the light through white linen cloth or calico*, yourself?—I have tried it partially, but not with sufficient accuracy to warrant an

opinion of its probable success; but being inexpensive, and taking up little time, I think the experiment worth trial.

Will you state the advantage you expect from the plan shown in the diagram; will the light so given illuminate the roof, and prevent the unpleasant effect produced on the former experiment by the ceiling being in gloom?—The advantages principally to be expected from this arrangement are, 1st, That the light can be brought down under the ceiling sufficiently low for the rays to pass the architectural mouldings, and illuminate it sufficiently; 2dly, It gives facility for placing reflecting surfaces to direct and diverge the light into the House at given angles, and in given quantities, so as to illuminate under the galleries, and the features of members in every part of the House, without falling offensively on the axis of vision. It differs from that of Sir George Cayley's (see dotted figure E F), and also Mr. Barry's, in form and situation. The latter, namely, its situation, &c., being such as to occasion the light to pass more obliquely into the House and under the galleries. It will be observed, on looking at the diagram of the House, that a light suspended from the centre of the ceiling D, must hang double the distance into the House at the point A, to give the same obliquity of angle as the one hanging from the point C. The figure of this pendant was designed, and given me by Mr. Rixon, as a shape more easily and inexpensively made than either Mr. Barry's or Sir George Cayley's, and offers facilities for practically effecting all the conditions which I have just stated.

SHOOTING STARS OF AUGUST LAST.

[Extract from a letter by Sir John South to *The Times*, No. 12.]

The evening of the 10th of August was fine, and for a considerable time the sky was cloudless. Busied in my observatory with my ordinary astronomical occupations, whilst the twilight was yet strong enough to render the leading article of *The Times* legible, though with some difficulty, a servant coming to me from a distant part of the premises put an early period to my astronomical work by announcing that "he had just seen the largest fire-ball he had ever seen in his life."

A celestial globe being brought out on the lawn for the purpose of tracing their tracts, and a loud beating clock being set with that at the transit instrument, by which the instant of disappearance of any of these bodies might be noted, between 22 minutes after 9 and 2 minutes after midnight 165 shooting stars were not only seen, but their flights amongst the fixed stars, and their disappearances to the nearest tenth of a second, registered.

Between 5 minutes after midnight and 29 minutes after 1 in the morning, 150 were seen. Clouds, which continued till daylight, prevented further observations.

Of these, the principal part resembled stars of the sixth magnitude, stealing from one part of the heavens to another. Many were as bright as stars of the first magnitude. Several had a brilliancy many times surpassing that of the planet Venus, whilst some few, apparently of a discal form, were not unlike the planet Jupiter, as seen with a magnifying power of 50 or 60. These, as well as those of the two preceding classes, prior to their disappearance, frequently burst into thousands of intensely luminous points, the light produced being such as to excite the attention of even the most careless bystander.

Having many years ago, when casually observing a magnificent one, (which caused a person whose back was turned directly towards it to startle at his post,) a strong impression that a report which I heard 42 seconds afterwards was referable to the spot where I had seen the explosion, I was on this occasion particularly on the alert for any such a recurrence (seeing that the distance of the object might thereby be nearly rigourously determined); but, although the night was particularly still, scarcely a leaf moving, not the slightest report could I ever think I heard. The directions which these fugitives took were very various, as was the extent of arcs they traversed; generally they took their course from the zenith towards the horizon: but in several instances they passed from horizon to zenith: some appeared when within 10 or 15 degrees of the horizon, and disappeared in it. Every part of the visible heavens teemed with them; the constellations, however, of Cassiopeia and Perseus were most prolific.

To-morrow, the 13th, Thursday, the 14th, or on Friday, the 15th, a recurrence of them is expected; and there is one phenomenon, which I distinctly saw on the night of the 10th of August, to which I would call particular attention; namely, the formation instantly on the explosion, and at the spot where it occurred, of a circular luminous cloud of one to four or even five degrees diameter, and which remained visible for a second and a half before it gradually disappeared.

Anxious, very anxious, to get a telescope upon them, I tried several times, but although a tolerably quick shot, I could never hit my mark. I have spoken, however, of degrees, but as many who may honour this with a perusal may want something like a value of them, let me say that the two

bright stars in the "Great Bear," generally known as "The Pointers," are a little more that five degree asunder.

Those who wish to get a telescopic glimpse of these luminous clouds, which have gone far to remove from my mind a preconceived opinion, that these bodies were possessed of no materiality (unless electricity can be considered such), must be supplied with a telescope of short focus and a little magnifying power; for unless its field take in a space of the heavens greater than the apparent cloud, contrast of its colour with the surrounding dark sky ground cannot be seen, and that alone will render the object visible. A common night-glass is the best instrument for the purpose, and must be held in the hand; it is, however much to be regretted that our English instrument-makers will not furnish us with some of varnished pasteboard make, and consequently more suited for the work.

J. South.

ANTHRACITE COAL FOR STEAM NAVIGATION AND STEAM-ENGINES GENERALLY.

The rapid increase of steam navigation, and the wide range it is now taking, render the economy of fuel a subject of the greatest importance. Of all descriptions of fuel, there is, perhaps, none in the use of which greater economy is to be attained than in anthracite. Up to the present time little progress has been made in its introduction into use for steam purposes generally, where it has been attempted the result having not proved so satisfactory as anticipated; the fact is, that the peculiar properties of the coal have either not been understood, or misapplied. The boilers generally used with bituminous coal are ill adapted to the perfect development of the powers of anthracite. When the use of this description of coal becomes more familiar, and its mode of acting fully ascertained, forms of boilers suited to its peculiarities will no doubt be gradually adopted; in the meantime, by a little contrivance, the present boilers may be adapted to the use of anthracite, so as to produce a very great saving of fuel, connected also with several other advantages, viz., a more steady and uniform heat, and consequent production of steam, a complete prevention of all annoyance of smoke and soot, and the removal of the huge cumbrous funnels from the decks of steam-vessels. In burning bituminous coal in the fire-place of a steam-boiler, a rapid and wide draught is necessary, because when that description of coal is thrown upon a hot fire a very large quantity of volatile matter is driven off with much force, carrying with it small particles of solid matter, *all of which would be lost as fuel was there not a current of air passing* with it along the tube or flues of the boiler to furnish oxygen for its combustion, which is too generally deficient, as in consequence of that deficiency a cloud of black smoke generally accompanies each application of fresh coal to the fire. There is nothing of this sort with anthracite, containing no combustible principle, but solid matter (carbon). A rapid draught must in all cases be attended with a loss of heat, but more particularly in the use of anthracite. At the same time, the important fact must not be lost sight of, that the great powers of anthracite as fuel depend mainly upon a rapid combustion. To attain these the application of a blast becomes necessary—not that of a strong powerful blast, but what is termed a soft blast, that of a fan widely diffused. The blast being conveyed from the fan through a box or tube, the full size of the fan is to be introduced into the ash-pit, the front of which is to be closed all but the opening left for the introduction of the blast, the same opening serving to remove the ashes from the ashspit. No alteration of the fire-place is necessary, excepting in the arrangement of the grate bars, which must be set very close together, and of different sizes, alternately thick and thin; thus, bars of two inches or one and a half inch square, to be set with two bars of half an inch to one inch square between each, the bars being one-quarter of an inch apart. By this arrangement the ashes may be removed from the fire by taking out portions of the smaller bars, the body of the fire being supported by the larger bars, which are to be left in their places. A small quantity of water must be kept running into the ash-pit, amongst the hot ashes, the uses of which are various and important. The closest attention and greatest nicety are requisite in supplying the coal to the fire, which must be preserved of an uniform thickness, never exceeding six inches. The coal broken into small pieces, not exceeding a quarter of a pound in weight each, and wetted (thoroughly saturated with water), must be supplied to the fire frequently, in very small quantities, care being taken to preserve the surface of the fire perfectly level, to insure the uniform action of the blast, the wetting of the coal with the action of the vapour from the ash-pit preventing the decrepitation to which anthracite is liable when suddenly heated. A very small chimney is required with this arrangement, and as the retention of the heated air in the boiler is of importance, it might be practicable to use a valve or damper, poised so as to have a slight preponderance to close, but yielding to pressure. This is a subject of great importance to steam-boat proprietors, and well worthy of their serious consideration. It is of equal importance to the pro-

prietors of mining property in Cornwall, as economy of fuel must be to them of paramount importance; and as anthracite can be supplied to them upon the easiest terms, the ports to which the bulk of the produce of their mines is sent, viz., Swansea, Neath, and Llanelly, being in the immediate vicinity of the great anthracite deposit of Glamorganshire and Carmarthenshire, anthracite must be the most abundant and cheapest coal that they can be supplied with. In a recent number of the *Mining Journal*, the results of some experiments by Dr. Ure, on the heating powers of several different coals were given, from which he estimates the heating power of anthracite (Welsh stone coal) at 12,000, that of Llangennech (considered hitherto as the most powerful generator of steam) as 9000, and that of one of the Wall's End coals of the north of England as 7500—leaving a very large balance in favour of anthracite,—*Mining Journal.*

NOTES AND NOTICES.

The Annual Showers of Stars.—There is in the November number of the *London and Edinburgh Philosophical Magazine* a curious article on the subject of shooting stars, founded on observations made on the night of August 10, 1839, written by Mr. Edward Cooper of Birmingham. The particulars are curious, but the article is not here noticed for the purpose of quoting details respecting the past, but as regards what may happen in a night or two. This article says that the general result of observations of the nights of the 10th or 11th of August furnishes a most remarkable exhibition of those interesting celestial travellers, and that experience fully justifies the prediction that these, and the nights of the 13th and 14th of November, will in future be their established galas, so that the admirers of "shooting stars" must be on the look out. On the subject of the shooting stars of August last, this article in the *Philosophical Magazine* observes that "the average number per hour in the half hemisphere to which the writer attended was 44, exceeding considerably the average of last year at Geneva." It adds, that a circumstance particularly worthy of notice this year is, that "several of the shooting stars appeared to move upwards, whereas no instance of this was remarked last year at Geneva."

Land Skates.—We have before us one of the most remarkable contrivances we have of late seen. It is a specimen of a pair of skates, invented by Mr. William Wallace, of Newtownards, watchmaker, and is in the highest degree creditable to that gentleman's scientific skill and perseverance. The machinery of this little locomotive is so arranged that it is equally serviceable on ice or on a smooth footpath (a flagged footway, for instance). It consists of two perpendicular plates of iron, with pieces inserted between them, to allow a free rotary motion to three wheels, revolving along the extent covered by the foot. These wheels revolve in the action of skating, and, with the addition of a horizontal plate of wood, elevates the sole of the foot above the surface. There is, also, a large wheel at the toe-end, with a ratchet or click-wheel attached, on the outside of one of the perpendicular plates, for the purpose of keeping the one foot from retrograding, while the other is progressing forward. After having seen this machine, we are somewhat surprised that a mechanical idea of the same kind has not before suggested itself to some of our ingenious countrymen.—*Belfast Whig.* [A similar kind of skate has been patented and was described in our first Vol. p. 38. The contrivance to prevent the retrograde movement is an improvement for which the Belfast inventor is entitled to credit.]

Hancock's Steam Carriage.—Yesterday (Monday 11th) an experimental trip was made in Mr. Hancock's steam-carriage as far as the eight mile-stone, on the Barnet-road, under the patronage of Mr. Hoggart, Mr. Smith, Mr. Snow, and Mr. Pattison (the directors and clerk of the Highgate Archway Road Trust), Sir James Gardiner, and several gentlemen connected with, and interested in, scientific matters. The start took place at 11 o'clock from Finsbury-square, and for a considerable portion of the distance affairs proceeded as well as could be desired. Eventually, however, it was discovered that part of the machinery was out of order, in consequence of the patentee, from pressure of business, as it was stated, not having taken the necessary preliminary precaution of overhauling the whole of its intricate works. The experiment, therefore, as to its first intention, proved a failure. The defect, nevertheless, was, to an extent, remedied, and the return to London accomplished within a very short space of time. Notwithstanding the comparative failure in the object of the day, it is but just to the inventor to declare that the obstacles which a large proportion of the scientific world had asserted to be insurmountable by means of a locomotive power on the road, namely, the ascent of hills or the obtaining a controlling command in making a descent, was by Mr. Hancock, on this occasion, proved to be visionary. The rate made going up the Highgate Archway, and other hills, was nearer six than seven miles in the hour, whilst that in descending was regulated at the will and pleasure of the conductor. With regard to the question as to the capability of the invention to travel over gravelly roads, the difficulty cannot be said yesterday to have been fairly tested; for whilst on the flat line of road, and on the journey up certain portions of the hills on which loose gravel or granite had recently been thrown, the passage was effected with the utmost ease, and with scarcely any perceivable loss of speed, yet on arriving within a few yards of the brow of the Baldfaced Stag Inn hill a stoppage of two or three minutes took place, in consequence of a want of sufficient power to propel the vehicle over it. A slight change in the direction of the carriage with the assistance of a crowbar having been made, the journey was continued. The parties more immediately interested in the invention subsequently explained the cause of this loss of power, by attributing it to an illegitimate escape of steam (one of the defects in the machinery before alluded to)—an event which a little previous foresight would have prevented. Altogether, therefore, the great principle, as to the ability to generate a locomotive power sufficient for the purposes of road travelling may be said on this occasion to have been fairly established. It is clear, however, from neglect in some quarter, that yesterday's trial was not, taken as a whole, quite so triumphant as it either might, or, under the circumstances, ought to have been. Another trip was talked of, and it is to be hoped that, if such should take place, every care will be observed, so as to render disappointment impossible.—*Times.*

Compressed Slack as Small Coal.—Coal merchants suffer great loss by the enormous quantity of slack which they are encumbered with, and which is sold at considerable loss. A Frenchman has lately exhibited samples of slack compressed into blocks as solid as well-formed coal. A mould, invented by the same individual, will enable one workman to prepare 30,000 kilogrammes of this material in one day! The invention is patented in this country by a Mr. Neville.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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BARNETT'S IMPROVED MODE OF WORKING GAS RETORTS.

Fig. 1.

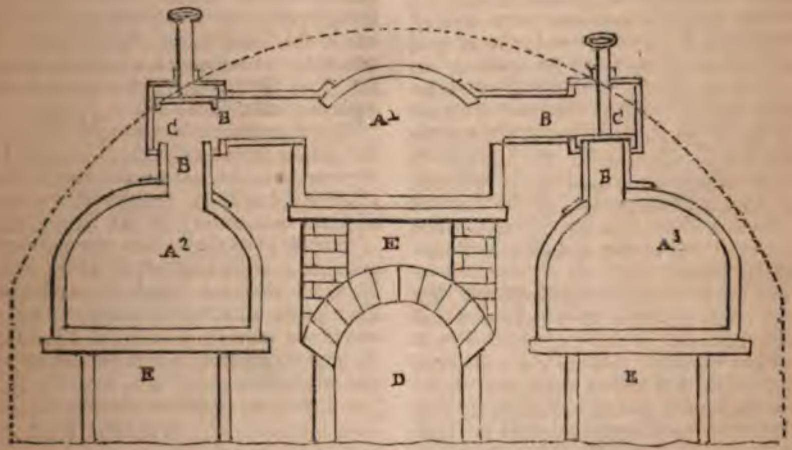
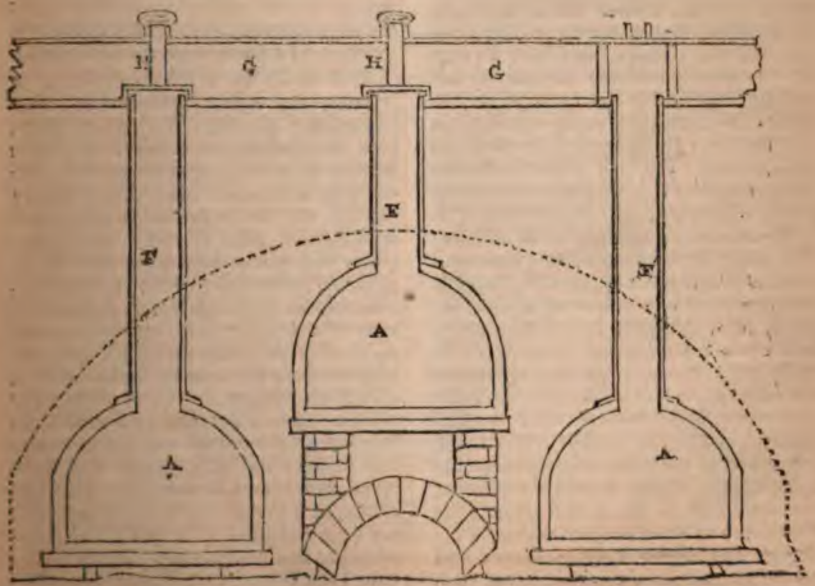


Fig. 2.



BARNETT'S IMPROVED MODE OF WORKING GAS RETORTS.

Sir,—I herewith forward you a description of a new mode of working gas retorts which I have had in successful operation here for some time. I shall be much obliged by your publishing it in your Magazine, which has already distributed a great deal of information upon the subject of gas manufacture.

By adopting my improved method, about from 2,600 to 2,700 feet of gas, more than by the ordinary method, can be produced from a ton of coals, whatever the kind of coal may be. This increase of gaseous product is effected by the longer time which the material is kept subject to the influence of the heat, so that a great portion of the tar and ammoniacal water is decomposed. The gas produced is also of a greater illuminating power.

Fig. 1 (front page) is a sectional front view of a retort bed with three retorts. There may however be any desirable or convenient number. Figure 2 is a sectional back view of the same retort bed. A A A are the retorts, which communicate with each other by means of the pipes B B B B. C C are two hydraulic valves, by which the communication between any two retorts may be cut off. Where three retorts are connected, two of them only need have valves—but where more than three are used every retort must have a valve. D, the position of the furnace, which communicates with the ovens E E E by means of small flues or apertures from the furnace. In figure 2, A A A are also the retorts; F F F, the pipes leading to the gas main G G. This communication may be closed by means of the valves H H.

The mode of operation is as follows: The retort A^1 is charged; one hour and a half afterwards the retort A^2 is charged; and one hour and a half after that, the retort A^3 is charged; in one hour and a half more the retort A^1 is ready to be recharged; the coal having undergone the usual process of six hours subjection to the heat of the furnace; and so on in succession alternately, each retort being submitted to the action of the fire for the same time. In the retort A^1 (supposing the operation to be in full action,) the first hour and a half or quarter time of the charge, the dense volatile matter and ammoniacal water of the coal is set free, and passes into the retorts A^2 and A^3, where, in connection with the carburetted hydrogen which A^2 is producing, and the sulphuretted and carburetted hydrogen which A^3 is producing, it is further distilled. Each retort will thus in succession be performing the stage of operation here represented. Previously to a retort being charged, its communication with the others, and with the main G must be cut off, by the valves C and H; and one retort only—that is to say, the one of the three (or any other series used) which has been longest subjected to the action of the heat,—must communicate with the main.

The figures are but roughly drawn, and all the parts except those relating to my improvement, are in skeleton. The exterior dotted lines represent the outline of the brick setting of the retort bed.

Should you think this invention of mine, of sufficient importance for publication, I shall be happy to send you descriptions of other contrivances relating to the same subject, which I have at various times made, experimented upon, and worked.

I am your obedient servant,

WM. BARNETT.

Brighton, Nov. 15, 1839.

ON THE CONSTRUCTION, PROPORTIONS, &c., OF SEA-GOING STEAM-VESSELS. BY LIEUTENANT WALL, R.N.

From the rapid extension and vast importance of steam navigation, every fact recorded by experience, and every branch of science connected with the subject, becomes of more than ordinary interest, and demands the attention and investigation alike of the scientific enquirer and practical seaman. Among the principal points upon which the improvement of steam navigation, in the present state of the science, is supposed to depend, may be reckoned the form and magnitude of the vessel; the material of which she ought to be composed; the relation most advantageous between the tonnage of the vessel and the power of the engine; the efficiency of the hold being fitted with water-tight compartments, as a preventive to the vessel filling from the effect of a leak; and some others of less importance. These topics have been treated with much ingenuity by men of science, and a considerable

portion of the periodical press have opened their pages to the discussion of the subject; but some of the conclusions arrived at have not received that confirmation from practical experience which would warrant implicit confidence being placed in their accuracy. It is therefore proposed to examine the grounds upon which we are called upon to adopt some of these novel theories, and offer such further suggestions as appear calculated to advance this truly national science.

One of the most important questions connected with steam navigation is the determining "*the solid of least resistance*," or, in other words, the power most suitable for a vessel to be propelled by machinery. On this subject the experiments of the Society of Naval Architecture, the French Academy, Colonel Beaufoy, and those by Sir John Robinson and Mr. Scott Russell, have thrown much valuable light, some of which were given in the *United Service Journal* for August, in which one important point appears to be tolerably well ascertained, namely, that the shape which can be passed through the water with the least resistance at a low velocity does not possess the same advantages at the higher rates of speed; in short it has been determined by Mr. Scott Russell, that there must be a peculiar form for each rate of velocity. It has also been ascertained that flat-floored vessels, when in motion, have a tendency to rise out of the water, thus diminishing the resistance to be overcome. But the hypothesis put forth by Mr. Russell, as to the form of the solid of least resistance, which he terms the *wave form*, and its application to naval architecture, requires to be received with some caution. It appears (*Mech. Mag.*, vol. xxxi, p. 445,) that that gentleman and Sir J. Robinson had been appointed a committee by the mechanical section of the British Association to investigate the phenomena of waves, and among other questions of hydrodynamical science, to determine "the nature of the connexion which exists between the generation of a certain description of waves in a fluid and the resistance of the fluid to the motion of a floating body moved through it, as in the instance of a ship." Mr. Russell having previously ascertained that the displacement of a fluid by a vessel took place, not in the body of the current, but solely by the generation of waves, the committee inferred the solid of least resistance would be found by having the same transference for particles of matter which was required for transference of waves. They wished to remove the particles of a fluid from a state of rest, and admit the vessel to pass through, and then allow them to return to their former places—just as in the wave, the particles were first elevated above the surface and then permitted to subside. Now, they found, whenever the displacement took place, as in the wave, they had the phenomenon of "least resistance;" so that in forming a floating vessel with this wave line disposed on each side of the keel so as to give such motion to the particles of water as to displace nothing more than was necessary to allow the vessel to pass, they obtained the solid of least resistance; since which time, we are informed by the report, a variety of experiments on a large scale had been performed; steam-vessels were constructed on that form, and that the fastest vessel on the Thames was one to which the wave form had been given. Mr. Russell, who brought up the report, expressed his conviction, that that was a form to which ship-builders must ere long be driven. It was the theoretical form of least resistance which he gave at Dublin three years ago, but it was not till he discovered the law of transference of the wave, that he found he had hit upon the very form of displacement of the wave. "Ship-builders," continues Mr. Russell, "had been in the habit of saying, 'whatever you do let us have no hollow lines;'" the maxim now would be, "let us have the hollow lines where we want them, and then we shall have plenty of scope for making fuller lines where they will not injure the progress of the vessel." The curve here spoken of has been termed the semicircular cycloid, or hemicycloid, and when two of these are united they produce a form similar to that shown in the diagram, in

which it will be perceived that the lines at each end are hollow. On the wave form here recommended for vessels, the reasoning and experiments are alike important and extraordinary; extraordinary as they differ essentially in their results from some of those instituted by the Society of Naval Architecture and others, to which much attention is due; and important they may well be considered, as supposing their truth established, the principles evolved must exercise a powerful influence upon the naval architecture of the country. It has hitherto been a received opinion among ship-builders and seamen, that hollow lines in the bow of a vessel below the water were injurious to velocity, and on reflection such a conclusion would appear founded in right reasoning; for what is a hollow line? It is a curve which in its progress has a *tendency* to approach a line perpendicular to the vertical plane of the keel; and how can the effect of such a tendency (no matter how remote) be otherwise than to impede in proportion the progress of a vessel so formed. Further, the wave form, as given in Mr. Russell's report, represents but one of the horizontal sections of a vessel, and no mention being made of any different line, it is to be inferred, that the bow and stem of a vessel built on the wave form, is to be composed of hollow lines from the keel to the water. But admitting (under the sanction of such high authority) that the wave line will produce the form of least resistance on an even keel and in smooth water, it should be remembered, that velocity is but one of the good properties which it is the object of a ship-builder to combine in a vessel, which in navigating the ocean has to encounter heavy seas and tempestuous weather, the qualities of stability and capacity would be injured by hollow lines; and in the event of a sailing vessel so formed having to work off a lee shore, or a steamer to stem the sea, in blowing weather; the vessel, in either case, would, in all probability, be driven under the water. Again, if the wave form be that of least resistance, in passing through the water in a horizontal direction, it must necessarily be so when the vessel is riding heavily at her anchors, or pitching and *scudding* in a sea way, those motions *would therefore be increased*, and the *velocity of the vessel* (if under way) *proportionably diminished.*

Although it remained for Mr. Russell to discover the theory of the wave form, yet the form itself, as applied to naval architecture, has long been in existence. There is now in the model room of the United Service Institution the models of two vessels, constructed precisely on the *wave form*, which were presented to the museum by John Jackson, Esq., from Canton.

Now that navigation by steam has absorbed nearly the entire of the coasting trade, and much of the European commerce of the country, the further advancement of that science must mainly depend upon its more perfect adaptation to distant voyages and the navigation of the ocean. To that end the opinion of naval architects and experienced seamen ought to be combined with the results of scientific experiments in determining the lines and formation of such vessels. The experience of the last two or three years has already pointed to the most obvious mode of effecting that object. The certainty, safety, and celerity of the passages made by the splendid steam-vessels on the American station, indicate clearly, that whatever other improvements may be effected in the formation of the vessel and arrangement of the machinery, great magnitude in the one and power in the other are indispensable to making distant voyages with steam-vessels with due economy: and certainly no position can be clearer or capable of more complete demonstration; for of the three dimensions of length, breadth, and depth, the resistance depends upon and is proportional to the two last only; whereas the dimension of length, although increasing the capacity and buoyancy of a vessel, in proportion to its increase, diminishes rather than increases the resistance to be overcome; and hence the progressive increase in size of steamers of every class, suggested evidently by the results of practical experience. Nor would it be very safe to predict where the increase of size (of the larger vessels) will terminate: because, although there may be a limit to the power of an engine, there can be none to the number which may be employed; nor are we aware of any theoretical limit to the size of a vessel to be navigated by steam.

The controversy whether timber or iron be the preferable material to be used in the construction of steam-vessels,

at present occupies the attention and divides the opinion of the mechanical world. The advantages of iron for that purpose, it is stated, consists in its superior strength in proportion to its weight, and the consequent lightness of a vessel constructed of that material; the facility and perfection with which the joinings of iron plates can be effected, as compared with the process of rendering the seams of a timber-built vessel watertight; and, lastly, the cheapness and abundance of the material, and the facility with which it may be wrought into the required shape.

But on the other hand are to be enumerated a long, and, as the writer believes, a preponderating list of objections to the exclusive adoption of iron in the construction of vessels. There is first to be considered the thinness of the metal of which the hull even of a large steamer is composed—about one-half or five-eighths of an inch. This want of substance would be seriously affected by the alternate action of the engine and beams, which would produce a corresponding vibration in the metal of the bottom. This action, sheet iron is by no means calculated to withstand, which would tend to produce extensive fracture in the plates and joinings; whereas, if sufficient substance be given to the sheets of iron to resist such tendency, the advantage in weight and expense over a timber-built vessel would be unimportant, and all elasticity destroyed; in whatever manner the metal might receive a bend or strain, the indentation would remain. There is also to be taken into account the effect of the oxydation which sea water would produce, and which would rapidly deteriorate the metal. On this point the experiments undertaken by Mr. Mallet, of Dublin, at the instance of the British Association, will, doubtless, afford important information. A vessel formed wholly of iron would be subject also to another action, namely, the effect of the expansion and contraction of the metal, by the different degrees of temperature to which it would be exposed, by which the different rivets and fastenings would be strained, causing them to work and perhaps to break. "In bridges," says Dr. Lardner, "and other structures formed of iron, mechanical provisions are introduced to prevent *fracture or strain, which would take place by the* expansion and contraction which metal must undergo by the changes of temperature at different seasons of the year, and even at different hours of the day."—(Lardner on the Steam-engine, p. 13.) If such provision be necessary to secure structures of iron from the effect of the alterations of temperature in one locality, how much more necessary does it become, in the case of a vessel sailing to different parts of the world, exposed to every vicissitude of climate and change of temperature, to which the atmospheres of Europe, India, and America, are liable? But as no such provisions can be introduced into the construction of an iron vessel, the effects of the changes of temperature become of importance, and ought not to be overlooked. Under these circumstances the writer is of opinion, that in the construction of large sea-going steam-vessels, iron by itself can never be adopted with advantage; but by a judicious combination of timber and iron, all the advantages of both would be secured, without any of the evils attending the exclusive adoption of either material. It is, therefore, proposed, that the shell of the hull be formed of sheet iron, as usual; but in order to impart to it the necessary strength and elasticity, and to secure the metal from oxydation, it is recommended that the bottom, from the *keel* to the "*bends*," be enclosed in a strong oblique framing formed of oak (or fir) plank of sufficient thickness, two series of which to be laid in opposite directions on each side, one over the other, and secured at the points of intersection by small thorough bolts of iron, setting up with a screw and nut, to stout "*ribbands*" of timber or metal running round the vessel interiorly, the exterior surface of the bottom being previously covered with tarred felt; the lower bolts of the planks to be secured by an additional garboad streak, filling up the angle formed between the keel and the bottom. It will be necessary that the heads of the bolts be countersunk in the surface of the planking, and filled in with pieces, rendering the apertures perfectly water tight. Over this coating of plank it is proposed to copper in the usual manner, having another covering of tarred felt interposed between the copper and the planking. In this manner vessels of any size and any degree of strength may be constructed,

and the system of diagonal planking, while strengthening a vessel composed of iron, in a remarkable degree would also impart considerable additional buoyancy, and consequently an increased tonnage.

We will here advert to and examine the principle of dividing the hold of a vessel into water-tight compartments, with the view of preventing the water from a leak gaining access to the entire hold of the vessel, a plan which of late has been much lauded. In the first place, the writer objects to the adoption of water-tight partitions, being an inversion of the principle which should govern the construction of a vessel. The ship builder, instead of anxiously directing his attention to prevent the water from gaining access to the interior of his vessel, considers such a casualty of but secondary importance, and directs his principal efforts to subduing the element after it has effected an entrance,—something after the fashion of a man, who, on a rainy day, would wear a water-proof dress inside of his coat instead of outside. But instead of cutting up a vessel's hold by a series of partitions, which, to be of any use, must be of considerable weight, rendering it unfit for its principal purpose, that of stowage, it would be infinitely better to trust to the vessel in the first instance, being constructed in a sound and seaworthy manner,—and if the risk of such a casualty as the springing a leak or getting on shore must be encountered (the chances of which are much diminished in steam-vessels) let it be met by good seamanship, experience and attention, qualities, the value of which the partitionists do not appear sufficiently to appreciate. But admitting, for the sake of argument, that the principle of water-tight partitions be good in itself. It is manifestly most injudiciously applied; the object of course is to prevent the rush of water from a leak in the vessel's bottom gaining access to the "hold" generally, and to confine it to the vicinity of the fracture—if so, where can be the necessity of extending the partitions from side to side, or even to the centre of the vessel, would it not be much better to place a second shell within the vessel, a few inches distant from the side, and secured to it by *cross stays, placed in the internal*; but *if one shell be good,* a second must be better, and so on until the entire space of the hold be occupied? It would be in vain to dwell on the numerous objections to such a plan, but it is hoped enough has been stated to show the plan of water-tight partitions is nothing better than a plausible absurdity.

From the advantages which have uniformly resulted from every increase of size in steam-vessels, it may reasonably be anticipated, that these vessels will, before any great length of time elapses have attained the size of 5,000 tons; vessels of such magnitude, would evidently require a corresponding change in the manner of working and conducting them, the evolutions of cruising or staying in a heavy sea, even with the assistance of powerful machinery would be slow, and perhaps hazardous, and the making a "stern board" the most approved mode of changing the direction of a steam-vessel's head, would be open to similar objection. In the navigation of crowded rivers and roadsteads, the necessity of *winding* steam-vessels round, occasions a considerable loss of time, and is frequently attended with casualties. It is therefore suggested, that it would at all times be desirable to be enabled to propel steam-vessels with either end foremost, and the vessel so constructed (the bow and stern being alike) would be stronger and safer than one of the ordinary build, and under much more effectual control. The difficulty would consist in being enabled to fit two rudders in such a manner, as that either of them might be used as a stern, and this difficulty, although undoubtedly great, the writer believes not to be insuperable. But he submits the consideration of the subject to those ingenious and enterprizing individuals who have already labored so incessantly and effectually to advance the science of steam navigation.

The principle of working marine engines with pure water must, we would suppose, command the unqualified approbation of every person at all conversant with the subject. The use of impure water, either for vapourization or injection, never could have been contemplated by the venerable authors of separate condensation (that basis of all other improvements in the steam-engine) and the destructive result produced in the boilers of marine engines, by the incrus-

tation formed from sea water, renders the condensation of the steam by the contact of cold surfaces, imperatively necessary. Without offering any opinion on the comparative merits of the different plans which have laid before the public to effect that object, the writer will detail a plan of his for supplying the condensating apparatus with a constant stream of cold water, which he believes would be more applicable to Mr. Hall's method of applying that principle than to any other plan. It consists of laying a tube of cast-iron on each side of the keelson, opening through the bows of the vessel, and leading aft into an air vessel situated above the water line, with which they communicate by upright pipes, having a valve opening upwards at their junction with that vessel. A communication is opened between the air-vessel and the condensing cistern containing the tubes, in which, by the force of the passage of the vessel through the valve a constant supply of cold water will be maintained. After the stream of water from the air-vessel has passed through the condenser, the surplus is carried off by two other cast-iron pipes, similarly arranged with the former, and issuing in the run of the vessel having a valve situated at their extremities opening outward; through these pipes the water would pass freely in consequence of the head of water in the air vessel, and the difference between the plus and minor pressure at the bow and stem of the vessel. This arrangement would also be applicable to other purposes, for if the communication between the air-vessel and the condenser be cut off, the water from the former might be conducted, by means of a hose screwed on the top to a height proportional to the velocity of the vessel, and applied to extinguish fire or other purposes.

Among the numerous desiderata still required to perfect the system of steam navigation, that of a well arranged mode of communication by signals remains to be accomplished. In the year 1824, the author invented a mode of illuminating the Semaphore Telegraph, which he laid before the Admiralty, the principle of which, he is of opinion might be rendered applicable to that purpose. It consists in attaching a powerful light to the pivot upon which the arm turns, or by other means, *placing it in the centre of motion*, and connecting the lantern in which it is enclosed with the arm, by which it would be carried round, and consequently the light transmitted (through a powerful lens) along the arm, in whatever position it might be in. The arms and mast being covered with a series of reflectors to reflect the principal rays at right angles to the place of the telegraph, they would present a highly luminous appearance, with this advantage, that whereas, in every previous system of signalizing at night, the configurations of lanterns were at any distance rendered confused by the general radiation of light from them, while in the plan here recommended, the source of light is concealed, and the arms and mast of the telegraph illuminated by reflection, which a bright and steady appearance would be imparted to the fire from that dazzling glaze common to all lights when the source from which they proceed is revealed. In applying this arrangement to maritime purposes, it is intended that the mast shall have but one arm only, which would be amply sufficient for all ordinary purposes of communication,—and in arranging the signal back to correspond, it will be necessary only to omit in each decade of members, the figures of the same amount, the 2. in 22., the 3. in 33., and so on. It is needless to say, that the telegraph here described would be equally applicable to day and night signals. When the distance between parties wishing to communicate is considerable, the mast might be swayed up to the top-mast head, by a mast rope, the heel being steadied by a few turns of a lashing; and the lanterns (at night) could be sent up separately, and fixed in their places after the mast was secured. In fitting a Semaphore in this manner, the pivot of the arm ought to be formed of a stand tube of cast-iron attached to it, so as to be carried round with it and partake of its nature, this would admit of a lamp, with a long stem, being passed through it from behind, which would therefore be stationary, but the lantern being attached to the tube would revolve with it.

It is a matter of surprize that so obvious a means of preservation from the effects of the various casualties to which all sea-going vessels are liable, as their being provided with life-boats, should not hitherto have been adopted. Some

years since the writer invented a life-boat of a peculiar construction, which was equally applicable to the saving of lives from vessels wrecked on the shore, and being carried with convenience on board ship, for the salvation of the crew and passengers in the event of their being obliged to leave the ship through fire or other casualties. It might be termed a pneumatic life-boat, being composed of inflated tubes of water-proof canvass, lashed together horizontally in such a manner, as to form a boat sharp at both ends like a whale boat, and the whole enclosed in a covering of strong water-proof canvass (*Mechanics' Magazine*, vol. xxiii, p. 385). But as the inflation of the tubes would require the use of an air pump, and from the chance of their being ruptured, which would render them useless, it was considered an improvement, to have the tubes stuffed with cork shavings instead of being filled with air; there was placed also on each side of the central tube (before being enclosed in the lamp cover) a fir plank, to impart the necessary strength and stiffness to the body of the boat, and which of course formed the stem, stern post and keel, tubes similar to those forming the sides were laid transversely at intervals to serve as timbers; the frame thus composed being firmly lashed together was enclosed in a strong covering of water-proof canvass, the seats for the rowers were formed of circular tubes of different diameters, and which also served to keep the sides of the boat from being crushed together, the description of a life-boat nearly similar to the above will be found in the appendix to the Parliamentary Report on Shipwrecks (1836). Without entering into any detail explanatory of these life-boats, enough has been stated to show it would be impossible to sink them, and being properly ballasted with bags of water, equally difficult to capsize them, and the planks at the stem and stern, not being connected with those forming the keel, the boat could not be injured by being run stern on to a rock or wreck; as the central tube would yield to the pressure. Life boats constructed on this principle could be taken to pieces and carried on board even a crowded ship without inconvenience, or transported along a coast to the vicinity of a wreck, by horses where a wheel carriage could not approach.

The writer is of opinion, that the intermediate shaft in steam vessels ought not to be in a line with that bearing the paddle-wheels; for in that case they would form but one continuous shaft, held down by eight different bearings, which the slightest alteration in the form of the vessel must necessarily strain and disturb. It is therefore suggested, that the motion of the engine be communicated from the intermediate shaft to the paddle shaft, by spur wheels, which, being fitted so as to slide (on either of the shafts) might be thrown out of gear at pleasure, disconnecting one or both the paddle-wheels from the engine.

ROBERT WALL, Lieut. R.N.

London, Nov. 1839.

NOTICE OF A DEFECT IN THE CONSTRUCTION OF THE DAVY LAMP.

Sir,—Allow me through the medium of your widely-circulated journal to call the attention of those interested in the Davy Lamp, to a defect in its construction which materially deducts from its safety, and I have too much reason to fear has been the unsuspected cause of many of those heart-rending explosions which rarely leave a survivor behind to explain their sad and mysterious origin. The defect I would point out arises from the very loose and insecure method by which the wire-gauge cylinder is attached to the brass ring which forms the screw whereby it is united to the lower part of the lamp. In forming the wire-gauze cage a low longitudinal overlapping seam is made down the whole length of the cylinder for the reception of which a notch is usually made in the rim of the lamp, but the fitting of these parts into each other is seldom attended to by those having the care of the lamp, and even when fitted the junction is so incomplete as to allow of the internal flame passing readily under the lower edges of the cylinder, and thence escaping between the outside of the cage and the ring which confines it. My attention was first called to this fact by a circumstance which occurred a short time since at a colliery in this neighbourhood. One of the workmen in descending the engine-shaft with a Davy Lamp, came in contact with an accumulation of gas which exploded at the lamp and burned the man severely. This occurrence naturally

excited much surprise and suspicion amongst the workmen who had hitherto placed implicit confidence in the safety of the lamp, and I was immediately informed of the fact by one of the proprietors who was most anxious to ascertain the cause of such an unexpected and untoward event. On a careful examination of the lamp I discovered the accident to have undoubtedly arisen from the cause I have alluded to, viz.—the imperfect connection of the wire-gauze cylinder with the lower part of the lamp which had allowed the internal explosion to pass under the edges of the cage, and thus to communicate with the inflammable mixture outside. Subsequently to this I have attended a lecture given to the members of a Mechanics' Institution in this neighbourhood by the well-known chemical lecturer, Mr. Murray, and having accidentally observed in the course of the lecture, that an explosion took place during the experiments with the Davy Lamp, I was led to point out to Mr. Murray at the close of the lecture the defective method of its construction, and on examining the lamp used by Mr. Murray on this occasion, it evidently appeared that the explosion during the lecture had arisen from that cause here referred to, and which Mr. Murray took the precaution to guard against in his future experiments. My principal object in troubling you with this communication is, that the attention of lamp manufacturers and others may be called to this important source of insecurity, and that some method may thus be adopted to obviate this great evil. I would just suggest, that could the cylinder be made without a seam, it would, in part meet the difficulty of bringing the outer surface of the gauze and the inner face of the connecting screw into closer contact, and if the lower edges were turned further under, and the screw brought dead down upon their flat surface, a close joint might possibly thus be obtained. The great utility and importance of the Davy Lamp, I most readily admit, I am consequently desirous that the principles on which it is founded, and which of late it has been too much the fashion to assail, should not suffer from those errors in construction which I have here pointed out.

I am, Sir, your humble servant.

THE BLACK DIAMOND.

Kilburne, near Derby, Nov. 14, 1839.

TIME TABLES.—AIDS TO ARTIFICIAL MEMORY.

Sir,—Mr. W. A. Kentish's "Improved Time Table," inserted at page 88 of your present volume, is very convenient for those who need it. It may be found in any of the old works upon chronology, the sole difference that I can discover being that Mr. Kentish has changed (doubtless for some good reason of his own) the good old seven Dominical letters into "*letters of reference*" of his own chusing.

But no tabular reference, were it so short as to be comprised even in a single line, can compete for an instant with the immeasurable advantages of a *mental* resource. *Access* is necessary to the former; the pocket must be searched or the desk must be opened; but the latter is never at fault; day or night it is always ready, and so perfectly familiarised does it become after a little practice, that it presents a decision, when required, almost intuitively. Who is there who, having at his finger ends the old quatrain,

> "Thirty days hath September,
> April, June, and November;
> February twenty-eight alone,
> And all the rest have thirty-one."

would give up its ready and constant assistance for the privilege of consulting a table?

It is with this conviction that I have endeavoured to reduce the Time Table into a mental process, as simple and as easily remembered as the lines just alluded to. The result is as follows, and whatever other merits it may possess, I claim for it, at least, that of perfect originality.

The first thing to be remembered is, what I shall denominate "the establishment of the months." It is as follows:—

April and July	Sunday.
January and October	Monday.
May	Tuesday.
August	Wednesday.
March, February, and November	Thursday.
June	Friday.
September and December	Saturday.

To assist the recollection of this the following lines may be used:—

> April loveth to link with July,
> And the merry New Year, with October, comes by;

August for Wednesday, Tuesday for May,
March and November, and Valentine's day;
Midsummer follows, and lastly appear
September and Christmas to finish the year.

Or it may be recollected by this singularity, viz., that if February be rejected (for which it is well adapted by its being the bissextile), the other months are exactly three months apart in the order in which they should stand, viz.:—April, July, October, January, May, August, November, March, June, September, December. The two first, fourth, and last days of the week having, then, the four first and the four last of these months, two each; and it being recollected that the rejected month, February, belongs to *Thursday*, the apportionment cannot well be forgotten; but the verses will be found to be the readiest means of acquiring it. Whatever means may be taken to familiarise the mind with the establishment of the months, it must be recollected that it is only *at first* that such an aid will be required; a very little practice will render it wholly unnecessary.

Supposing the establishment of the months impressed on the memory, the rest is easy. For the present century the rule is as follows:—To the two last figures of the given year add their fourth (disregarding the remainder) together with the constant number two, and divide the sum by seven. If nothing remain, the establishment of any given month is the day on which it commences; but if there be a remainder, then such remainder *added to the establishment* will give the first day of the month. In the present year, for instance, (1839,) $39 + 9 + 2 = 50 \div 7$; one is the remainder, which being added to Thursday (the establishment for November), gives Friday as the 1st, 22d, and 29th of the present month. The only thing to be attended to in leap year is, that the establishments of January and February in that year must be reduced by one day. Hence in next year (1840) $40 + 10 + 2 = 52 \div 7$, three is the remainder, which, being added to Sunday (the establishment for January *reduced for leap year*), gives Wednesday as new year day; but for March, it must be added, as usual, to its proper establishment (Thursday), giving Sunday as the first of March. In conclusion I may remark, that this latter process, short and simple as it is, will only have to be gone through once in the year, since the remainder, once ascertained, serves the whole year through.

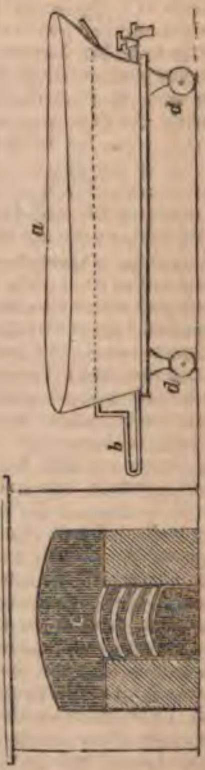
I remain, &c. &c.,

NAUTILUS.*

Leeds, Nov. 17, 1839.

ECONOMICAL PORTABLE HOT BATH.

Sir,—The following novel plan of heating a bath was communicated to me by Mr. Le Croix, of Upper Norton-street, New Road, Regent's Park, whose idea it is; and thinking from its simplicity, it deserved being made public, I respectfully offer it for insertion in your valuable pages, if you think the plan merits a place in them.



*We should be extremely sorry to lose so talented a correspondent as "Nautilus." He must, however, see the necessity of our using a discretion in the insertion or refusal of articles; although in exercising such discretion we may give offence to some parties. We cannot please all, but we would willingly offend none. That we may sometimes err in our judgment, and have done so, we admit—*Humanum est errare*.—Ed. M. M.

In any room with a grate *c*, a fire is to be made, the bath *a* filled and wheeled towards it, being fitted on large castors *d* to move readily; the tube *b* attached to the bath, which is adjusted to the height of the bars is then inserted between them; in a short time the water will be heated to the degree required, when it may be wheeled to any part of the room without the least annoyance.

I remain, Sir,
Your obedient servant,
G. M. BRAITHWAITE.

2, White Lion Court, Cornhill,
November 14, 1839.

ASTRONOMICAL QUESTION.

The latitude of the Royal Observatory at Greenwich, is 51°. . 29′ N, long. 0. . 0, Edinburgh, 55°. . 57″ N, long. 3°. . 12′ W; on what day or days in the year will the Sun rise and set to both places at the same instant of time?

IVER M'IVER.

THE "ROYAL GEORGE" OPERATIONS.—SUBMARINE ILLUMINATION.

We make the following extracts from a letter to the editor of the *Times* from Colonel Pasley, dated Chatham, Nov. 16, 1839, upon the subject of the operations for the removal of the wreck of the *Royal George*. We can readily imagine the unnecessary trouble and, perhaps, annoyance which the Colonel may have experienced from the over-zeal of numerous inventors, each one with his "infallible remedy"; but such suggestions are not always to be scouted or thrown aside without examination. The Colonel argues that, because he has done well, it is impossible that he can do better. This we cannot concede. Since it is impossible to light the whole wreck, might not *one* experienced diver explore the various parts in detail, and thus acquire a knowledge of their relative situations, which would enable him to direct the operations of others with more certainty and effect? A perfect plan of the wreck even might thus be obtained by consecutive examinations and admeasurements, and laid down upon paper, which we cannot help thinking, would most materially assist the Colonel and his assistants in planning the mode of procedure likely to be most effective:—

"I have received a number of letters, not only from several parts of England, but even from Paris, offering or recommending to me various lights to be used under water, one of which is said to have the novel property of burning in a vacuum; and therefore I am anxious, as the means of saving further trouble to others as well as to myself, to declare publicly, that though I have often considered the subject, I never expressed the smallest desire to use a light under water, nor did I ever authorize any person to make known that such was my wish, for I never thought that such a light would be of the smallest use.

"The simple fact of our having recovered 12 guns, 5 gun-carriages, 100 beams and riders, or large fragments of them, exclusive of other timbers, planks, and copper, besides the cooking place and boilers complete, the stem, and great part of the bows on each side of it, the two capstans, part of the mainmast, and all that remained of the foremast of the *Royal George*, which were to be seen at Portsmouth very lately, will afford a sufficient proof that no light was wanted to guide us in our operations. The parts of the wreck are far too large to require a lamp to look after them, and if they did, I would send it down in a diving bell. One of the two divers employed by me always used Mr. Bethell's patent diving helmet, &c., the property of the Admiralty, lent to us, from the stores in the Portsmouth dockyard, which helmet was actually fitted with a moveable lantern in a very ingenious manner, but which the divers immediately took off, and never used it at all, as they agreed with me in opinion that it was useless; and even if it had been thought worth while to try it, it would have been impossible that the diver and his lamp both could have been supplied with sufficient air, without a much more powerful pump and larger air pipe than belonged to Mr. Bethell's apparatus. The idea of sending down a detached light is no novelty to me, it having been proposed by a Mr. Rowe in 1753, whose diving machine, as he terms it, a very bad one, is described in the *Edinburgh Encyclopædia*, but not his light, which I have only seen described in a manuscript copy of his pamphlet, and which he proposed to supply with a draught of air by a couple of pipes led into the lamp from a boat at the surface of the water.

"The reason why I think that lights at the bottom would be useless is, that I do not see the possibility of their illuminating more than an insulated point of the wreck. If they could diffuse a general light over the whole mass, they would be of the greatest benefit, but not otherwise.

* * * *

"The divers informed me, soon after we commenced our operations in August last, that on going down to the bottom outside of the wreck on a calm day, when the sun shines, they can just distinguish the outline of it as a dark mass, but nothing more.

"It was reported in some of the newspapers, that part of the wood-work of the *Royal George* had floated along the coast and was found covered with barnacles, and that the mainmast, which had drifted away from the wreck, was picked up by a boat belonging to the consul for the Netherlands. These reports were quite incorrect. No part of the *Royal George* ever rose to the surface after our explosions, except some large fragments of the mainmast, which were immediately recovered by the boats on duty and carried into the dockyard, and no barnacles were found on any part of the wreck, to which a number of oysters, and ectiniæ, or sea-anemonies, only, had attached themselves in great abundance. The most accurate reports of our operations were contained in the *Hampshire Telegraph*, in which I only observed one trifling error."

RECENT AMERICAN PATENTS.

[*Selected from the Franklin Journal for Sept.*]

Spring Draft and Bumpers, for Railroad Cars; *Peter Alverson, New Haven.*—The patentee informs us that the object of his invention is "to prevent the jerk usually experienced in the first movement of connected cars, and the jar occasioned by the concussion when suddenly stopped, by interposing elastic chains, or spring drafts and bumpers, both made with strong spiral springs as described, thereby preventing, or greatly lessening, the effect both of the jerk and of the concussion."

The elastic chain, or spring draft, consists of an apparatus of strong spiral springs coiled around stationary, and sliding rods under each end of the car, the chains or links by which the cars are connected being attached to the sliding part of this apparatus will necessarily, to a certain extent, produce the intended effect. The bumpers, or elastic cushions, are to be attached in the usual manner to the front and rear draw bars of the carriage bed of each car, and these also are to derive their main elasticity from similar spiral springs, coiled upon rods of iron in their rear. The claim is to "the combination of spiral springs with the other machinery, as specified."—[See a description of a plan similar to this, patented in *Great Britain*, by Mr. T. F. Bergin, the ingenious *Secretary of the Dublin* and *Kingstown Railway, vol. xxiv, p. 1.*]

Eccentric Brake for arresting the motion of Railroad Cars; *Ephraim Morris, New Jersey.*—Between the two wheels on each side of a car there is to be a cam wheel, one part of which is to be a segment of a circle, resembling the periphery of one of the wheels; another portion of the periphery of the cam is in a straight line, probably of two feet or more in length, and the cam may be made to roll round on its circular or curved part, and to bring this straight part upon the rail, which, whilst it bears upon it, will lift the wheels at one or both ends therefrom. The straight portion of the cams are furnished with flanches which embrace the rail. This part, by its friction upon the rail, is to operate as a brake upon an inclined plane, or elsewhere. The claim is to the foregoing arrangement of the respective parts.

When it is desired to relieve the brake, this is effected by backing the cars, when the ordinary wheels are made to rest upon the rail, the lower side of the brake being then free from them; there are, of course, some particular devices described which we have not noticed, nor do we think it necessary, being apprehensive that the contrivance is not destined to be adopted.

Cutting the Teeth of Circular Saws, *Thaddeus Sellick, New York.*—One, two, or more, steel plates, prepared to have teeth cut upon them, are to be placed upon a vertical spindle capable of revolving on its two ends. These plates are to be made to bear against a revolving cutter, consisting of an endless screw, the thread of which is in such form as to cut a saw tooth. A cutter two inches in diameter and half an inch in thickness, has been used for the purpose. The revolution of the cutter will cause that of the saw plates, which are borne up against it. It is remarked that the teeth of straight saws may be cut by a similar device.

"What I claim, is the employment of a circular revolving cutter, having a thread or channel on its periphery, running in the manner of an endless screw, and so arranged and combined with the other parts of the machinery employed, as to cause the cutter to cut, and to feed the plates to itself, by its own action, the whole operating substantially in the manner above set forth."

Covering the Roofs of Buildings with Sheet Metal, *J. B. Duval, Charlston.*—"The object of my invention, is to lay on the tin plate in such a manner as shall allow a free expansion and contraction of the metal, whilst the whole covering is effected without the use of solder in any part, or the driving of nails through any of that portion of the tin which constitutes the covering. It is stated that the mode adopt-

ed by the patentee is analogous to some which have been previously known, but the "difference of my mode of procedure and that in which the edges of the tin are curved up, and slit tubing is passed over them, or other analogous means of allowing for expansion and contraction will be apparent, as I allow for it effectually with all the seams closed down by the mallet."

PRESERVING TIMBER, *Edward Earl, Savannah, Georgia.*—We published in our last number (*Mech. Mag.* p. 117,) the specification of a patent for a similar purpose, the gentleman above named being one of the patentees. The mode of procedure in the present case is like that described in the former patent; that is, the timber is to be boiled in the solution by which the preservative quality is to be communicated, which solution is to consist of sulphate of copper, (blue vitriol,) and sulphate of iron, (copperas,) dissolved in water. One part of the sulphate of copper to three of sulphate of iron, are to be taken, and about three pounds of the mixed salts added to every gallon of water. The timber after being bored through its length, is to be boiled, and afterwards suffered to cool in this solution. The claims made, are to "the boiling of timber as described, in a solution of sulphates of iron and copper; applying this solution to the interior as well as the exterior of the timber, by means of the central perforation when the size of the timber requires it, as the most effectual mode of protecting it from the ravages of insects, and of rot. I do not claim the saturating of timber by a solution of sulphates in water when applied cold, but confine my claim to boiling it, as above set forth, in that solution, during from two to five or six hours, or more."

We think that most of our remarks on the former patent, are equally applicable to that before us.

METAL COMBS; *Richard A. Ives, Bristol, Connecticut.*—A strip of sheet metal is provided, of a width equal to that of the intended comb, and of a thickness equal to that meant to be given to the teeth; this metal is to be bent or plaited in a zig-zag manner crosswise, the bends being of such width only as shall adapt them to the forming of a single tooth; this crumpling or bending may be effected in the first instance by rollers, resembling crimping rollers; these plaits are then to be pressed up together, whilst a similar piece is interposed between each plait, to form the spaces between the teeth; this being removed, ribs are to be soldered on each side of the crumpled plate, to form the middle or back of the comb; the metal on each side is then to be cut away, to liberate *the teeth, and the comb is to be finished up by filing, buffing, &c.* The claim is to the foregoing mode of forming metallic combs.

EXTRACTING COLOUR FROM DYE WOOD; *Laurens Kent, Dorset, Vermont.*—This invention consists in extracting the colour from dye woods, reducing the same to a gum or powder, in a pure state, and in greater quantity than can be produced in the common way of boiling.

"I construct a steamer or tub sufficiently large to contain four or five hundred pounds of ground wood, said tub standing on its end; eight inches from the bottom I fix a fine strainer, the tub above the strainer is then filled and made perfectly tight; through the centre of the head I enter my steam-pipe through the boiler or still, which is of brass or copper; the steam condenses in the wood, and leaches into the space below the strainer; strong liquor is thus drawn off, and put again into the boiler, and the water or liquor run off again into the wood, as before, leaving the colouring substance in the boiler, which is taken out and dried. As the colour or gum of some dye woods cannot be exhausted perfectly with water, I sometimes make use of alcohol, and in that case I enter a worm below the strainer, seven inches from the bottom of the tub, to condense the alcoholic steam that comes through the wood.

"What I claim as my invention is the manner herein described of extracting the colour from dye woods by steam and distillation, reducing the same to a gum or powder in a pure state, separate from the wood, to be used in dyeing and staining."

EXPERIMENT WITH ANTHRACITE COAL IN A STEAM-VESSEL ON THE THAMES.

[Abridged from the *Times.*]

Mr. Player has invented a fire-place which is exactly suited to the peculiarities of anthracite, enabling it to become slowly heated up to the burning point, and preventing its disturbance afterwards. The arrangement is very simple, and easily applied to steam-boilers. As no smoke appears, at first sight it strikes the observer as if the coals to be burnt were thrown down its short chimney until it was completely choked; but on looking more closely, he perceives that this strange-looking little chimney is the "feeding funnel" by which the anthracite is propped up in a tall heap over the fire and resting on it, where it remains with its lower stratum growing hotter and hotter till it kindles; then, as the burning mass on the grate beneath is gradually consumed, the layer just in contact with it sinks quietly into its place, where it in turn becomes fully ignited, and so on. The red-hot burnt air (not flame) is carried round about and through the steam-boiler by flues as usual.

and then flies off, without a particle of smoke to mark its progress, through the real chimney at the other end of the furnace.

When so much had been satisfactorily accomplished, and the power obtained of raising steam in any quantity by anthracite coal, it was determined to build an iron steamboat on the exact model of the four improved vessels already running on the Thames (*Daylight*, *Moonlight*, *Starlight*, and *Twilight*), to ascertain the value of this new fuel by direct comparative experiments. The perfect absence of smoke from the chimney of the *Anthracite* (for so the new iron steamer has been named) is a phenomenon perfectly refreshing to the eyes, noses, lungs, and palates of all who frequent the river or its banks, of late years, alas! the region of filthy smoke-clouds, emitted by the omnibus steamers to save a daily trifle that would be lost by the consumption of coke. Experiments recently made have ascertained that one ton of anthracite, burnt in a proper fireplace, will raise as much steam as one and a quarter ton of common coke. This fact, therefore, places the latter fuel at a serious discount, even at present rates, as it would require 30s. worth of coke to do the work of 27s. of anthracite. The trials against flaming (or rather smoking) coals are yet to be made, and arrangements are in progress to conduct them with satisfactory accuracy. If the anthracite shipments obtain encouragement, it will find its way to the Pool at much lower rates (some calculate at 22s. per ton), whereas, if the consumption of the common coke were increased, the gas works would speedily raise the price.

The *Anthracite* made an experimental trip from Hungerford-stairs to Woolwich and back again on Monday last, with a number of scientific and professional men on board, amongst them the writer of this article, who made a point of viewing every thing with his own eyes; although he must do the parties concerned the justice to declare that they afforded every possible facility to arrive at the facts, and appeared to desire nothing better than the most complete publicity.

The grand novelty—the furnace for burning anthracite to raise the steam (on which, indeed, the entire success of its application as a fuel must depend) is secured by patent, and the legitimate object of the company is to introduce it into every steam-boat, by the simple argument that it will enable it to burn a smokeless fuel—a cheaper and a more effective article than the ordinary smoking one.

As all travellers by land and by water will doubtless wish them "God-speed," they will be glad to learn that the opinion of the critical party who witnessed the performance of the *Anthracite* was highly favourable, so far as the experiment went. "The conduct of the new furnace" was, of course, the chief topic of attention, and was examined and watched with scrupulous attention. Although the boiler is small, it sufficed to generate an abundance of steam; in fact, the engine was working at 45 strokes per minute, which is said to be something above the proper speed. The peculiarities of the fuel were very striking. Its power of conducting heat is so trifling, that the upper surface of the mass in the feeding funnel right over the fire gave no indication of the heat beneath; and when the fire-door below was opened for an instant (contrary to rule) to allow incredulous amateurs to take a peep, they still beheld black coals resting on the surface of the red ones. The fire-bars are laid sloping away from the funnel, so that as the fuel descends it spreads equally over the extent of the grate without the aid of a stoker. No slag or fire-cake results from the fuel, and the few cinders which fall through the narrow bars still contain so much carbon that they are thrown into the feeding funnel again. The little "stoking-room" (*lucus a non lucendo*), more properly the engine-room, is from the absence of all meddling with the fire only of a comfortable temperature—an advantage on a tropical voyage, to be fully estimated by those who have stoked half their livers away on board the *Atalanta*, the *Berenice*, the *Hugh Lindsay*, &c. In fact, there are no "stokers" on board the *Anthracite*; the ordinary crew can throw the coals into the funnel, and take out the few cinders beneath at their leisure. The "fire-doors" are never opened to feed the fire, as all that goes on upon deck through the funnel (as millstones are fed through a hopper, but this does not hop), and consequently the fire is never half extinguished (as in ordinary fireplaces) by a fresh supply, with the necessary evil results in addition, of steam checked, power lost, and smoke emitted. The combustion of the anthracite goes on smoothly and equally, like that of the oil in Parker's new lamp, which is heated almost to the boiling, or rather burning point, before it is inflamed in the wick. Mr. George Rennie, who seemed to take a great interest in the experiment, caused the fuel to be weighed during the trip, and found that the quantity for producing the effect of one-horse power for an hour was 6¼lb.; but this, from the short duration of the experiment, can only be looked upon as an approximation. Much yet remains to be ascertained, but the power of anthracite to raise sufficient steam is no longer doubted.

In the practical conversation, which was freely entered into throughout the trip, four great points were admitted as special advantages resulting from the employment of anthracite in steamers:—

1. The coolness of the engine-room as aforesaid, and the preservation of the health of all occupied with the machinery, render it peculiarly suitable for voyages in warm climates.

2. The natural compactness or condensation of this coal (the steam-producing power being directly proportioned to its purity) will enable trading steamers to make longer voyages with the usual weight of fuel, or, in going their ordinary voyage, to make more room for stowage of the cargo.

3. To diminish the cost of fuel for steam-navigation by bringing into the market not not only the anthracite coal fields of Great Britain and Ireland, but also those of the United States. It will considerably diminish the cost and risk of a Transatlantic trip to be certain beforehand of finding in the port of New York a supply of anthracite from the Pennsylvanian collieries fully equal to our own.

4. In time of war the absence of smoke may be of the greatest moment in concealing the approach of an armed steamer, or rather in not betraying its existence as such to the enemy. If this exemption from cognizance as a craft possessing the power to

"Walk the waters like a thing of life,"

were combined with a positive prevention of danger to the machinery similar to that afforded by Smith's "screw propeller," which works quite under water (and which is the invisible motive-power of his new vessel the *Archimedes*), the combination would probably be invincible. Certainly it would place a single-armed steamer very much at her ease even in the vicinity of a hostile fleet of ordinary sailing frigates of the old school of naval architecture.

DIFFERENCE OF LONGITUDE BETWEEN GREENWICH AND NEW YORK.

[From the *Athenæum*.]

I have the satisfaction to inform you of a second instance of the successful transport of chronometers from London to New York, for the purpose of determining the longitude of these two cities. The first, as you will remember, took place in the months of July and August last. The result then obtained was compared with that given by M. Daussy, a distinguished French hydrographer, in the *Connaissance des Tems*. The difference of these results was 2.63 sec. This was satisfactory under the circumstances of a first attempt, made in the first trip across the Atlantic of the *British Queen*; still I felt the difference to be too great to be permitted to remain without an attempt to diminish it, or to ascertain which of the two was nearer the truth. *On the very next voyage, therefore, of the same vessel, and under the* same friendly auspices of Captain Roberts, and my friends in the United States, I sent a second set of four chronometers from London to New York. Their rates, &c., were ascertained precisely as those of the first set, and the whole experiment conducted in the same manner. This voyage of the *British Queen* was made, out and home, in the last and present months. The result, I have the pleasure to announce, is this time, almost exactly the same as that of M. Daussy's; so near, indeed, that I feel it to be a duty, and one of the most pleasing nature, to express thus publicly my great admiration of the accuracy of his statement:—

	h.	m.	sec.
By this second experiment the difference of longitude between the Observatory at Greenwich, and the City Hall, New York, is	4	56	0.24 W.
According to M. Daussy it is	4	56	0.72
Difference of the two observations	0	0	0.48

The difference of the two observations does not therefore amount to half a second! For all the purposes of practical navigation it may be regarded as nothing.

This very minute variation in the estimates of the astronomical distance of two meridians so widely separated as those of London and New York, will be very gratifying to every lover of practical science both in France and England, the more so, when it is considered that these estimates were made independently of each other, "by different observers, in different years, and in vessels propelled by different agents." Perhaps it ought not to be omitted, that in both the English experiments the instruments were sent out unattended by any *savant*, and brought home their own report.

During the first voyage there had been observed in all the chronometers, a difference between the mean travelling rate and the mean stationary rate, which had the remarkable character of being always on the same side, viz., the *losing* rates were always *increased*, and the *gaining* rates always *diminished*. The same curious fact again occurred in the second voyage. From this circumstance the longitude of New York was given by each chronometer scarcely enough to the westward in the outward-bound voyages, and rather too much so in the homeward ones.

The great rapidity and accuracy with which this important branch of nautical inquiry may be pursued over the whole surface of the globe, as the agency of steam shall be extended, is now, I think, demonstrated. The instances under consideration show that observations may be made connecting very

distant countries, and their several results compared in a few weeks—a circumstance of great consequence—for with the diminution of duration in a voyage, proceeds, in a higher degree, the diminution of all the chances and causes of error in chronometrical experiments at sea. Within the space of ninety-nine days, we have seen the *British Queen* carry chronometers *four* times across the Atlantic, and give ample time during each of her visits to New York for the necessary observations of rates, &c.

All objections founded on the idea that the motion of a steam-vessel would affect injuriously the more delicate movement of the chronometer, and taint the results, must now fall to the ground. In the two voyages out and home of the *British Queen*, no derangement occurred, and the determination of the longitude of the far-distant ports she sailed between, is, probably, settled for ever, within the fraction of a second of the truth.

I am, &c., ED. J. DENT.

84, Strand, 8th Nov., 1839.

NOTES AND NOTICES.

Weight of Blood in the Human Body.—The following account of the quantity of blood in the human frame at the different stages of existence, is given by Dr. Valentin on the *Bulletin Général de Thérapeutique Médicale*:—In the male subject, the blood at birth weighs 0.73 of a kilogramme (the kilogramme is 2lb.); at one year, 2.29; at two years, 2.75; at three, 3.03; at four, 3.46; at five, 3.83; at six, 4.14; at seven, 4.62; at eight, 5.10; at nine, 5.52; at ten, 5.99; at eleven, 6.38; at twelve, 7.11; at thirteen, 8.10; at fourteen, 9.28; at fifteen, 10.64; at sixteen, 12.24; at seventeen, 13.16; at eighteen, 14.04; at nineteen, 14.52; at twenty, 14.90; at twenty-five, 15.66; at thirty, 15.80; at forty, 15.78; at fifty, 15.47; at sixty, 15.02; at seventy, 14.45; at eighty, 14.04.—In females, it is as follows: At birth, kilogramme, 0.59; at one year, 1.88; at two, 2.31; at three, 2.52; at four, 2.87; at five, 3.14; at six, 3.39; at seven, 3.74; at eight, 4.02; at nine, 4.55; at ten, 4.90; at eleven, 5.32; at twelve, 6.19; at thirteen, 7.03; at fourteen, 7.72; at fifteen, 8.37; at sixteen, 9.01; at seventeen, 9.95; at eighteen, 10,77; at twenty, 11.04; at twenty-five, 11.17: at thirty, 11.18; at forty, 11.49; at fifty, 11.85; at sixty, 11.50; at seventy, 10.89; at eighty, 10.45.

The Seasons.—A writer in a late number of the *Edinburgh Journal* enters into an examination, from the comparison of meteorological records, of the prevailing opinion that the temperature of the weather, and indeed the general character of the seasons have sustained some remarkable changes in our island. He comes to the following, we think just conclusion upon the subject. "We thus see, by irrefragable evidence, that in these years, selected at random from the last century, there was the same mixed hot and cold weather as we now experience—the summers abounding in cold disagreeable days, and the winter's cold interrupted by occasional mild weather. The conclusion to which every candid mind will arrive is, that it is in a great measure an erroneous conception, that the winters were so much colder and the summers so much warmer in past years than they are now. The reason, it seems to us, why the belief alluded to is entertained by people of advanced years, is simply, that the very hot years and very cold years which they have seen in the course of their lives, have left a strong impression on their minds, while all the others have been forgotten. Thus, on calling up their weather recollections, they find only a number of these remarkable years engraven on their memories, and as the intervals are blank, they not unnaturally fill up the picture with tints of the same kind as those remembered."

Mr. Joseph Strutt, of Derby, is about to give a further proof of the interest he takes in the welfare of the townsfolks of Derby—we might say of mankind. He has entrusted to Mr. Loudon, the celebrated author on gardening, the planting and arrangement of eleven acres of ground, which, when complete, are to be given to the public for the recreation of the increasing population of that industrious town. We hope such an example of generosity will meet with imitators.

Ancient Inventions, &c.—"Nautilus" writes us, in reference to Mr. Trevelyan's communication in No. 846, that—"For the purpose of calling in question the originality of a description of an ancient fire engine, which was extracted into your pages from some old book, he adduces the same description in another old book; which, having been published only 12 years earlier, and in a closely neighbouring country, can only be looked upon as contemporary, neither being, most probably the original. But Mr. Trevelyan does not appear to be at all aware of the copious and most interesting exposition of the subject which was given by Mr. Baddeley, in number 798 of the *Mechanic' Magazine*. * * * Again, in another part of the same communication, Mr. Trevelyan repeats nearly the same words, with respect to planispheres, as had already appeared long before, in No. 824. There is one thing new, however, in his remarks upon the subject, when he declares that his planisphere, "manufactured by his Majesty's globe makers," is made exactly similar," to that described at page 70, vol. xxxi; if so, I must say, his Majesty's globe makers must have been very incompetent persons, as the description, so referred to, contains many glaring defects and misconstructions."

Improvements in Locomotives.—The following is a description of a new invention, applicable to locomotive engines, which is considered by a number of scientific men (as railway travelling is proceeding so rapidly) well calculated to supply a desideratum, and which is likely to prove a great national benefit, by reducing the expence, and increasing the safety, of internal intercourse:—The advantages of it are—*First*, the condensing the steam after it escapes from the cylinders, and the water produced thereby returned to the boiler to be wrought over again and again; by which means the boiler is rendered more durable, being kept perfectly free of incrustation or deposit of any kind; and no stoppage is required to take in water; of course freeing the engine of the burden of carrying a supply along with it.—*Second*, The air that supports the combustion of the fuel is considerably heated previous to entering the ash-pit; by which the smoke is completely consumed, although fresh coal be used in the furnace. Consequently a great saving in the consumption of fuel is effected. It is pleasant to add, that an experiment has been made with the apparatus, which is exceedingly simple, and found to answer all the purposes intended, and for which a patent is in progress. The inventors are William and Andrew Symington, whose ingenious talents are likely to be of as great benefit to their country as those of their father, the late William Symington, celebrated as the author and introducer of practical steam navigation.—*Edinburgh Chronicle.*

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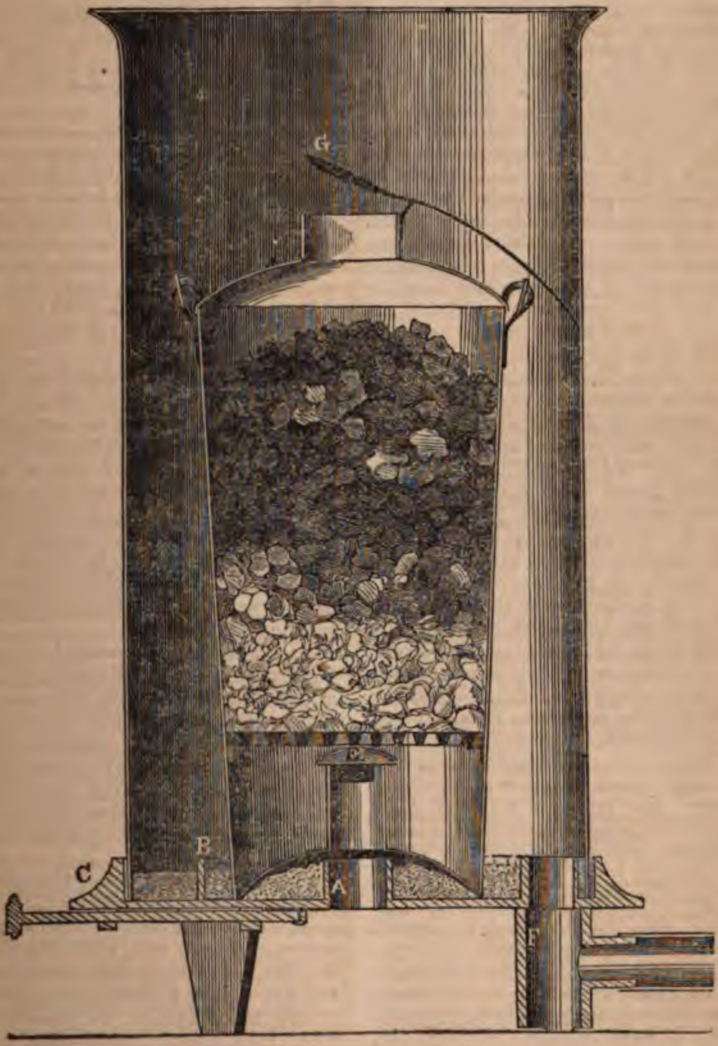
PROSSER'S PATENT CHUNK STOVE.



PROSSER'S PATENT CHUNK STOVE.

The approaching recurrence of the winter season (of which whilst we write we are sharply reminded by a shower of sleet) has brought with it the announcement of a multitude of devices for the alleviation of its attendant discomforts. The last year's frosty atmosphere was warmed with a goodly supply of carbonic acid from Joyce's charcoal burner; the year before was characterized by the Arnott mania; but the present winter will be prominent in the annals of warming and ventilating, not for any particular plan, (unless it be that of the subject of the present article,) but for the great number of stove doctors that have obtained diplomas to practice, by paying the fees of the patent offices. The cheapness of fuel in England has, until of late years, kept out of the action of the probe of the professed inventor the primitive and un-scientific methods usually adopted in making the heat obtained from combustion useful in diffusing domestic, official, and personal warmth; whilst on the continent, where the material is dear, the closest attention and most refined ingenuity have been exercised in the matter. The Parisian porter, who warms his "*concierge*," and cooks his meals, with a handful of charcoal a day—or the Dutch vrow, who boils her kettle with a few ounces of carbonized turf, would look with amazement at the quantity of bright blazing coal burnt by an English person in the same station of life, and for the same purpose. But a revolution is now in progress in this matter. In one provincial paper, (the *Midland Counties Herald*) which we have just taken up, we observe advertised no less than six new stoves, viz.—"the Olmsted Patent Air Stove," "Chesterman's Patent Self-regulating Water Stove," "Smith and Co.'s Patent Arnott Cooking Stove," "the Leamington Patent Air Stove," "the Patent Healthy Urn Stove," and the subject of the present article, the "Chunk Stove."

This new candidate for public favour—but to which no favour is likely to be shown unless it merit it,—is the invention of Mr. Richard Prosser, Civil Engineer, of Birmingham, a gentleman well known in the mechanical world for his talent and ingenuity. It is extremely simple, correct in its principle of action, light, neat, and easily set or removed; as to its other advantages we must allow its proprietors to speak for themselves.

Before proceeding to unfold "the advantages" of the invention, we must observe, that a rather *mal-à-propos* quotation has been chosen to grace the prospectus. All who have read Dr. Kitchener know that he was a great lover of a good coal fire, and it was not without an oblique reference to the heating apparatus-doctors of his day that he apostrophised his readers:—"Ye, who from caprice or parsimony sit shivering and murmuring, and refuse to employ the *coal merchant* as a substitute for the sun, may soon spend in *physic* more than has been saved in *fuel*." The good doctor, of course, could not have referred, by anticipation, to Mr. Prosser's invention, and we should be most happy and gratified to find that the words *Chunk Stove* could be substituted for *coal merchant* in the above excerpt.

"The advantages of the Chunk Patent Stove, are, its entire freedom from dust or smoke, its very great economy of fuel, and its perfect safety. This stove has no door or other aperture out of which smoke, dust, or effluvia can pass into the apartment—hence its promotion of health and cleanliness; after a fire is lighted, all that this stove requires by way of *attention*, is, 'to let it alone' for twenty-four hours—hence the economy of time resulting from its use.

"'When your apartments,' says a medical writer, 'are contiguous, keep them at the same temperature, and remember that colds are caught nine times out of ten in the house. We suddenly change *Bengal* for *Siberia*, by going from a warm room into a cold one, and attribute our rheumatisms, coughs, and consumptions, to our *climate*, instead of our *folly*.'

"Those who are fond of the morning fragrance—dust and litter of cleaning grates, and the racket of shovels, tongs, pokers, fenders, and coal-hods during the day, must *forego* these pleasures in the use of the Chunk Stove, which is chiefly recommended to persons of a more quiet turn of mind, who, during winter, or a 'severe English spring,' may wish for the climate of Naples with-

out the trouble of a voyage. Wherever warmth is required, this stove is applicable; and its use, in all cases, prevents drafts of cold air into the apartment, and that dryness of the atmosphere which is so injurious to health. It may be used to warm entrance halls, dressing-rooms, laundries, nurseries, drawing and dining-rooms, greenhouses, schools, counting-houses, store-rooms, offices, ships' cabins, workshops, houses of industry and correction, lunatic asylums, cabinet, musical instrument makers and joiners' work-rooms, printing offices, drying-rooms for paper, linen, gunpowder, drugs and chemicals, japanning and lackering-rooms, for airing unoccupied rooms or recently erected buildings, and for the important purpose of housing grain in wet harvests, and drying bricks, tiles, and pottery. The fire touches no part of the outer case of the stove, it cannot, therefore, become over-heated so as to burn or vitiate the air of the apartment; it may be placed in any part of the room, and the smoke conveyed in a two-inch *leaden* pipe, a convincing proof of its *safety*."

The following description of the invention is an abridgment of Mr. Prosser's specification:—

"My apparatus for heating apartments, consists in a peculiarly constructed stove, which I denominate, for the sake of distinction, 'The Chunk Patent Stove.' It is formed of three essential parts, namely, a base or stand, a portable furnace or fire pot, and an envelope or case. The base is a circular plate of cast iron, standing on three feet, with three concentric rings on its upper surface, having an aperture in its centre, and a valve adjusted to such aperture, to regulate the admission of the external or atmospheric air, and a tube or flue for the escape of the gases of combustion, in the manner hereafter described. The portable furnace consists of a conical bucket of sheet iron (with or without a lid or cover) having an iron grate inside, supported at about one-sixth part of the depth of the bucket by three studs or brackets, projecting about half an inch on the inside, which prevent the grate from being displaced by the weight of the fuel, and forming underneath the grate an ash pit or receptacle for the ashes or dust *caused by the combustion of the fuel employed. In the centre of the ash*-pit is placed a funnel or chimney, covered at the top to prevent the ashes falling through and perforated on all its sides to admit the external air. From the centre of the lid of the bucket a short tube projects, covered with a valve which closes by its own weight, when the envelope is removed from the base, and when the stove is in use, a lever opens the valve by pressure against the envelope. The envelope, or case, is a cylinder of sheet iron closely covered at the top, and adjusted at the bottom to the upper surface of the base of the stove. When it is desired to use the stove it is requisite that the tube for the escape of the gases of combustion should be let into a chimney, common air flue, or be connected with the atmosphere in any other suitable manner, so as to cause a draught of air through the stove; a sufficient quantity of sand is then to be strewed between the rings on the upper surface of the base of the stove to prevent the escape of smoke or vapour; fuel is then to be put into the fire basket or furnace, which is to be placed over the aperture in the base; and the envelope is lastly to be adjusted over the furnace and on the base of my stove. It will be obvious from this statement, that when the stove is thus in use, the external air for maintaining combustion is admitted through the aperture A in the base of the stove and up the funnel at the bottom of the furnace into the ash pit, formed between the grate which supports the fuel and the bottom of the fire bucket; the air then passes through the fuel, and the gases evolved during combustion are carried upwards through the tube in the lid of the fire bucket, and thence downwards between the outside of the furnace and the inside of the envelope into the flue F, communicating with the external air. Or in case of there being no flue, the gases may be exhausted by mechanical means and delivered into the atmosphere at any suitable place. The stove is shown, as in use by the sectional elevation (see front page), and it will be perceived, that the valve G in the lid of the furnace is kept open (as it must be to allow of combustion going on) by the lever pressing against the inside of the envelope. The ring in the centre of the base of the stove is for the purpose of preventing the sand falling through the aperture A; the next ring B, is to receive the fire-bucket,

and the outer ring C, to receive the rim of the envelope. The bottom rim of the fire-bucket, and the bottom rim of the envelope are placed in the sand upon the base of the stove, by which the passage of air, or smoke, in that direction is prevented. A fusible compound of metals may be used, in lieu of sand, within the rings of the base of the stove, to prevent the escape of the gases of combustion; but I have found fine sand to answer the purpose, and it is more economical, and is what I use in my stoves. I have obviated the great objection against close stoves, of their becoming too *hot*, in consequence of their contact with burning fuel. In the construction of the stove, no part of the envelope is in contact with the fuel, but is situate at such a distance from the furnace as prevents its being over-heated, and cannot, therefore, contaminate the air of any apartment. When, for the purpose of ornament, or durability, the envelope is made of cast iron, or other heavy material, its removal, in order to replenish the fire bucket, would, on account of its weight, be objectionable; in such case I obviate the necessity of removing the envelope by making the top only of such envelope moveable, and making the same air-tight by grinding the top into the cylinder which forms the envelope; or by sand, or fusible metal, as before described. On removing the top of the envelope, the furnace can be withdrawn and replaced, for the purpose of removing ashes, and recharging the apparatus with fuel. When the envelope is made of very light material, to facilitate its removal, it will require, in some cases, to be connected to the base of the stove by catches, to prevent the accidental removal of the envelope, and the consequent escape of vapour. I have not described how a regulator may be attached to the valve of the stove, because the modes are well known, and I think it much simpler to operate upon the valve by the human hand; such regulator may, of course, be applied, and I leave the choice of the mode to those who shall require it."

The whole invention is so simple, that the publication of the above detailed description was, perhaps, hardly necessary; but we anticipate that it will be the favourite of the season, which has induced us to give so much space to its details. *The whole thing, in fact,* would be immediately understood from the following directions for use:—"Remove the outer case of the stove; withdraw the fire-pail, and take off the cover; place the pail upon one corner of the kitchen fender, or upon something that will admit of the air drawing in at the bottom; throw into the pail, to the depth of five or six inches, burning coke or cinders from the kitchen fire that have ceased to smoke; in a few minutes afterwards, when it is seen that they are well kindled, fill the pail with coke or cinders. If the latter could be obtained in sufficient quantities, it would be as good as any fuel that can be used, but as that cannot always be done, it is necessary to state that coke must be used. When the pail has been filled as above directed, put on the cover, replace the pail on the bottom of the stove, and put on the outer case, giving it a slight to and fro motion, so as to fit it into the sand, with which the whole of the bottom must always be kept covered half an inch deep; see that the valve rod is drawn out. Should the heat be too great, partly close the valve; to extinguish the fire, entirely close the valve. The stove will not require attention oftener than once every twenty-four hours, at the expiration of which time remove the pail, empty it of the ashes, not any of which can fall out during the consumption of the fuel, or the removal of the pail; replace the grate in the pail upon the brackets provided for it, and charge it with fuel as before."

We close our notice of the "Chunk" with a statement of a few experiments, for the accuracy of which we can vouch.

The experimenter's office is 20 feet by 18 feet, and 9 feet high; it has three external walls (that is, walls which are exposed to the weather), and three windows; the area of glass, in the three, is =72 square feet. The fire-bucket, or furnace, contains, when full, 16lbs. weight of coke.

Temperature of room.	Temperature of external air at same time.
$61\frac{1}{2}$°	57°
$66\frac{1}{2}$°	52°
$68\frac{1}{2}$°	44°
65°	40°

The above are the results of experiments on four different days.

AUTOBIOGRAPHY OF THOMAS TELFORD.

name of Thomas Telford was sally recognized—at least through- e more advanced stages of his ca- as beyond all question that of the vil engineer of his age and coun- hat country being pre-eminent all others for the magnificence and of its public works, and that age which the science of civil engi- g had risen to a height of estima- ıknown to previous times, through ieer force of the vastness of its ınd the combined utility and gran- f its productions. Commensurate, re, in some degree, with this wide of his reputation was the interest l by the announcement conveyed public along with the news of his e, that the latter years of the great er had been chiefly occupied in ing a detailed account of the prin- vorks which he had planned, and o see executed;" and it being also l, as a circumstance fortunate for rld, that he had "completed" the ected manuscript" of his narrative lays only previous to his death, its immediate publication was natu- ooked for, and indeed awaited with mpatience. It was never antici- that *four years* would be suffered se before the work reached the eye.

s but fair to Mr. Rickman, under editorial superintendence the ppears,* to allow that the preface it plain that the delay which has place, great as it is, has been ow- circumstances which did not ad- foresight or control; and this, too, hstanding Mr. Telford left the in a much more forward state of ation than might have been sup- even from the announcement we lluded to, the text not only being ed at the press, but nearly sixty costly copperplates composing the nion Atlas being actually com- . It appears to have been almost y owing to the unfortunate illness, ed by the death, of Mr. Turrell, the eminent engraver to whose care Mr. Telford had confided the execution of all the engravings, that the appearance of the work has been so much retarded; and without the plates it would have been incomplete indeed.

It is to Mr. Rickman that we are indebted for the original hint of the publication. That gentleman observes in the Preface:—

"This work originated very naturally when Mr. Telford began to withdraw himself from undertaking new professional engagements, and, from a growing infirmity of deafness, felt himself uncomfortable in any mixed company. In this predicament, it was obvious to suggest to him that, in his intended transition from activity to leisure, he might yet do good service to the public, without too much fatigue to himself, if by degrees he renewed acquaintance with all his accumulated papers, making such a selection from them as, aided by his own recollections, might display to the public all the great works executed under his superintendence, and all the improvements introduced by him during the third part of a century of extensive practice in his profession."—Preface, p. 5.

So far we think Mr. Rickman entitled to every credit for his suggestions, but we cannot allow he was so clearly in the right when he advised Mr. Telford to pay no attention whatever to order or arrangement in the drawing up of his narrative. A chronological arrangement seems the most natural, but any, however defective, would have been preferable to leaving things as we find them in the detail of Mr. Telford's "professional labours," where, without the slightest thread of connection being perceptible, we have a work executed perhaps in 1803 preceded by one of the date of 1833, and followed by another of 1815; and all these so little similar in other respects, putting date out of the question, that the first may be a bridge, the second a road, and the third a canal! Surely, a little more formality than this could not have proved detrimental, or by possibility any other than a great improvement.

The opening portion of the work is, indeed, more methodically written, and this portion is decidedly the most interesting as an "autobiography." It is devoted to the narrative of Mr. Telford's life from his herd-boy days on the banks of his native Esk, to the commencement of his grander engineering labours on

e of Thomas Telford, civil engineer, written elf: containing a Descriptive Narrative of fessional Labours; with a Folio Atlas of lates. Edited by John Rickman, one of his rs; with a Preface, Supplement, Annota- d Index. *London: Payne and Foss.* 4to. *84 plates*).

the Ellesmere Canal. The details are sufficiently minute to enable the reader to accompany him in every step of his onward career; and such details—those of a successful struggle from obscurity to a place "high in the rolls of fame"—are ever sure of exciting a pleasurable sympathy as well as a powerful interest. Mr. Telford himself seems to dwell upon all that relates to his youthful days with a natural predilection, and above all, that Eskdale is evidently ever nearest to his heart, one of whose chief boasts will henceforth be, that it was the birth-place of the constructor of the Menai Bridge. He thus characteristically alludes to the cherished spot in an early passage of his memoir:—

"I ever recollect with pride and pleasure my native parish of Westerkirk, where I was born, on the banks of the Esk, in the year 1757, and where also were born that eminent brotherhood of the Malcolm family, four of whom have risen to high rank, and the honour of knighthood, in the service of their country; of whom two have been made Grand Crosses, and one a Knight Commander of the Order of the Bath. I was for some years a schoolfellow of the elder brothers of that distinguished family. Colonel Pasley has since emerged from the same neighbourhood. It was left for him first to demonstrate the folly of squandering the reputation of the English army in desultory expeditions. * * * * Nor ought I to omit that Colonel Pasley has applied the test of experiment to the pressure of earth, and other materials, and, by thus rectifying the unfounded theories hitherto prevalent, has rendered essential service to the civil as well as the military engineer."—p. 14.

Mr. Telford's attachment to the place of his birth was, indeed, shown in a variety of ways; amongst others, he invoked the Muse to celebrate its glories. In the present memoirs, indeed, he seems inclined to drop the strong claims he possessed to poetic distinction, as he nowhere makes mention of any of his metrical productions; but Mr. Rickman in some measure makes up for this deficiency, by reprinting the whole of his poem, entitled "Eskdale," in the course of the Appendix. We think Mr. R. might have ventured further in this direction, and found space for some of the numerous pieces from Telford's pen, of a more homely but more hearty character than the somewhat lofty toned and artificial poem with which he has favoured us. In all the real requisites of poetry, we hold, for instance, Telford's verses to Burns on the "Cotter's Saturday Night" to be far superior; and certainly they do not yield a jot in point of interest, taken in connexion with the facts with which the Memoirs make us acquainted. Let us extract a specimen, the principal figure in which is a Scottish Shepherd-boy—a figure which Telford had at least some pretensions to delineate with accuracy:—

"Say how, by early lessons taught,
(Truth's pleasing aid is willing caught
Congenial to the untainted thought,)
The shepherd boy,
Who tends his flock on airy height,
Feels holy joy.

"Is aught on earth so lovely known,
On Sabbath morn, and far alone,
His guileless soul all naked shown
Before his God;
Such pray'rs must welcome reach the throne
And bless'd abode.

"O! tell with what a heartfelt joy
The parent eyes the virtuous boy,
And all his constant, kind employ,
Is how to give
The best of lear he can enjoy,
As means to live!

"*The parish school, its curious site,*
The master who can clear indite,
And lead him on to count and write,
Demand thy care—
Nor pass the ploughman's school at night
Without a share:

"*Nor yet the tenty curious lad,*
Who o'er the ingle brings his head,
And *begs o' neighbours books to read*—
For hence arise
Thy country's sons, who far are spread,
Both bauld and wise!"

To fill up the measure of our interest in these verses, it is only necessary to add, that Telford has in them literally sketched from the life, and that life his own. He was himself the pupil of the parish school; himself the "tenty curious lad" he drew; and who illustrated most happily in his own person the solid truth of the concluding lines. Nor did his good feeling towards the scenes of his youth evaporate in mere words. By his will Mr. Telford left 1000*l.* each to the two parishes of Westerkirk and Langholm, with the excellent proviso that the produce should be expended in the purchase of books for their village libraries, to save the future "tenty curious lad"

the necessity of "begging o' neighbours books to read"—a procedure, however, with reverence be it spoken, to which many of his countrymen, as well as Telford, have been indebted for the foundation at least of their name and fame. Why Mr. Telford should have omitted all allusion to his poetic efforts—which most assuredly are no dishonour to their author—it would be difficult to conjecture, though it may be alleged that one who, in the maturity of his powers, produced "poems in stone and iron" vying in sublimity with the sublimed scenes of nature, amidst which they are placed, might well despise the credit attached to his works as a mere pen-and-ink author. That he ever retained a cordiality for "the idle trade" is nevertheless evident from another passage in his will, wherein he bequeathed 500*l.* each to "Robert Southey, poet-laureate," and "Thomas Campbell, poet."

We have seen that Telford's original position was not one which seemed favourable for the acquirement of a reputation like his, nor would a common observer see much greater opportunities in the situation he was next found in—that of a common journeyman mason. Not so Telford himself; he traces much of his subsequent success to the experience acquired in this very humble stage of his career; and his forcible reflections growing out of the record of the fact are well worth a careful perusal at a period when the profession of the civil engineer is making every day such rapid strides towards "gentility." After noticing his being employed in building the bridges, churches, ministers' houses, &c., in his native district, he thus proceeds:—

"In all these convenience and usefulness only are studied, yet peculiar advantages are thus afforded to the young practitioner; for, as there is not sufficient employment to produce a division of labour in building, he is under the necessity of making himself acquainted with every detail in procuring, preparing, and employing every kind of material, whether it be the produce of the forest, quarry, or the forge; and this necessity, although unfavourable to the dexterity of the individual workman, who earns his livelihood by expertness in one operation, is of singular advantage to the future architect or engineer, whose professional excellence must rest on the adaptation of materials and a confirmed habit of discrimination and judicious *superintendence. My readers* may not dissent from these observations; but few of them, unless practical men, will feel their full force. Youths of respectability, and competent education, who contemplate civil engineering as a profession, are seldom aware how far they ought to descend in order to found the basis of future observation. Not only in the natural senses of seeing and feeling requisite in the examination of materials, but also the practiced eye, and the hand which has experience of the kind, and qualities of stone, of lime, of iron, of timber, and even of earth, and of the effects of human ingenuity in applying and combining all these substances, is necessary for arriving at mastery in the profession; for how can a man give judicious directions unless he possesses personal knowledge of the details requisite to effect his ultimate purpose in the best and cheapest manner? It has happened to me more than once, when taking opportunities of being useful to a young man of merit, that I have experienced opposition in taking from him his books and drawings, and placing a mallet, chisel, or trowel in his hand, till, rendered confident by the solid knowledge which experience only can bestow, he was qualified to insist on the due performance of workmanship, and to judge of merit in the lower as well as the higher departments of a profession in which no kind or degree of practical knowledge is superfluous. For this reason I ever congratulate myself upon the circumstances which compelled me to begin by working with my own hands, and thus to acquire early experience of the habits and feelings of workmen; it being equally important to the civil engineer, as to naval or military commanders, to have passed through all the grades of their profession."—p. 2.

Mr. Telford, it is plain, would have had little mercy on any scheme for forming practical engineers by means of a "collegiate" education conducted on *genteel* principles. Like most eminent men of the same calling, he entertained a feeling little better than contempt for *mere* theoretical studies, and even held the opinion, that a pupil of mathematical attainments would stand a less chance of success than one with no mathematics at all. Mr. Telford was, indeed, in every respect a thoroughly practical man; no wonder, therefore, he should set a high value on a thoroughly practical education in the science of which he was at the head. From a working mason he became a superintendant of building operations, from thence an architect, and in due time, by passing gradually from the

erection of houses to that of bridges, he commenced his labours in engineering, a line in which his genius was destined to achieve for its owner a renown such as the theorists may hardly ever expect to attain in a pursuit so remote from the speculative regions in which he delights to wander. This first part concludes with Telford's formal entrance on his new profession, as engineer to the Ellesmere Canal.

The second part is devoted to descriptions of all the great works in which Telford was engaged during the long remainder of his life,—and it is here that the want of order we have already alluded to is most painfully felt. As a matter of necessity, also, the *man* is here nearly lost sight of in the stupendousness of his productions, and the book ceases almost entirely to bear the character, and to possess the peculiar interest of a piece of auto-biography. We must even be permitted to observe that Mr. Telford has unfortunately been more sparing of that information which he alone could supply, with reference to what may be termed the *mental mechanism* connected with his grandest productions than could have been desired. It has been said that " the life of an author may be best read in his works,"—the same remark would apply with at least as great force to the engineer,—but in both cases it is perhaps not so sound in reality as in appearance. There is always a *history*, and a history which the world longs to know, belonging both to the conception and the execution of the great works of either,—and it is this which renders the auto-biography of eminent men so attractive. Others might prove,—most likely *would* prove, better critics and better commentators; but others cannot guess at the springs whose action produced the grand result; or trace the idea in its origin, its growth, or any thing but its full maturity. It is a pity, therefore, that Mr. Telford confined himself to such a description of his labours as—with more research and less accuracy doubtless,—might yet have been achieved by other hands.

Nearly every undertaking which Mr. Telford conducted, of more than ordinary importance, receives its share of attention, but those to which the largest space is devoted are, the Chirk and Pont-Cyssylte Aqueducts,—which first proclaimed the bold sweep of his engineering genius:—the Caledonian Canal,—a work which has proved in every respect less successful than it deserved to be;—the Nene Autfall and the drainage of the Bedford Level,—two of the most useful local improvements of the age;—the Aberdeen and other Scotch harbours,—works which have made less noise in the world than others of much inferior consequence;—the Highland roads and bridges,—undertakings of immense extent and variety, and calling for the almost stretch of strength and fertility of resource in the directing mind;—the St. Katharine's Docks,—unrivalled for the celerity, as well as perhaps for the excellence, of their construction;—the Holyhead Road, which in all its parts Mr. Telford was himself inclined to consider the greatest and most perfect work on which he had ever been engaged;—and, last, but not least, the " Menai Bridge,"—the stupendous, and yet fairy-like structure with which the name of Telford is inseparably connected throughout the civilized world. On all these we are presented with ample details; but on all we could wish for more, and those of a closer—a more personal interest. This is also especially the case with another work to which considerable space is worthily devoted,—the Götha Canals in Sweden; a great public work conducted in a foreign country, and under the auspices of a foreign government, by a British engineer. It is evident that a narrative of what may be called the *interior* history of this remarkable passage in Telford's life,—such a narrative as, from his own recollections, he might have easily and gracefully given, would have imparted a living interest to this portion of his auto-biography which it cannot now be admitted to possess. A few paragraphs do indeed just glance at the peculiar circumstances of the case, and one of the plates presents a copy of the medal struck on the occasion by the Swedish government;—but this is all! On another occasion of a similar but less important nature,—the formation of a remarkable road in Poland for the Russian government ("not for the first time," as Mr. Rickman remarks) Mr. Telford is even less communicative; he says not a word on the subject! His friend and editor does certainly in some degree make up for this deficiency in the ap-

pended "Supplement;" but the information he supplies is only such as to raise a regret that Mr. Telford himself should have so completely overlooked his own foreign labours.

"The most distinguishing trait of Telford's character was, that facility of benevolence which made him accessible to all, especially to foreigners, who resorted to him for information or advice; and this, added to his connection with the Götha Canal in Sweden, exalted his fame abroad as the first civil engineer in Europe, several years before he was acknowledged at home to hold that station. The Russian government consulted him frequently on various schemes of canal navigation and other improvements, and the younger Worontzoff, who might be said to have been educated in England, was familiarly received by Telford on all occasions; and no doubt the Russian improvements on the coast of the Black Sea (over which that nobleman now presides) profit by his English recollections. The Emperor of Russia was not inattentive to the imperishable services of Telford, and sent him a brilliant diamond ring, with an appropriate inscription. It has already been said, that Telford was honoured by a Swedish order of knighthood; at home he became Fellow of the Royal Society of Edinburgh in the year 1803; of London, 1827. M. Dupin obtained from Telford, and acknowledges in fit terms, the unreserved communication of all English improvements in civil engineering; and foreigners distinguished by science and literature, who thenceforth visited England, resorted regularly to Mr. Telford,—Russians, Swedes, Germans, French, and Italians. The magnanimity of communication without reserve, he thought befitted the character of England as well as his own; and he imparted as much knowledge on all occasions as he deemed the applicant was capable of receiving with advantage."—page 285.

Telford may be said to have presided over his profession during the period between two great eras in engineering, the age of canals, and the age of railways. Of the former mode of conveyance he was the great improver, the latter came too recently upon the scene to receive much of his interference, but, strange as it may seem, they did not come too late to meet with his reprobation! He, the greatest perfectionator of the modes of travelling he found in use when he commenced his career, appears to have had no *corner in his toleration for the yet more splendid* improvement which was destined to cast even *them* far into the shade. The following extract from the commencement of his account of the Liverpool and Birmingham Junction Canal will show that he held railways in general for mere bubbles of the hour, and the Birmingham and Grand Junction Railways, in particular, as next of kin to dreams impossible to be realized!

"The project for this canal (B. and L. Junction) originated in the year 1825, when a boundless rage for speculation had seized upon every object which ingenuity or invention could suggest; and, *as the price of iron was depressed*, the iron-masters, to promote the consumption of that material, encouraged the construction of railways in sundry directions, the most important of which was a proposed line from Liverpool, through Birmingham, to London, *all physical obstructions being forgotten, or overlooked, amid the splendour of this gigantic undertaking*."—p. 86.

It is remarkable indeed, that one who had been the foremost man of his time in "annihilating both time and space," should have set his face so decidedly against what was in some sense a continuation, though in another a superseding, doubtless, of his most fondly-cherished labours. Still more so that an engineer, who had "hung" vast structures "high in the empyrean," and whose every-day conceptions were the impossibilities of common minds, should have passed the same judgment on an undertaking, which, (gigantic and splendid as we may admit it to be) the experience of a few short years has shown to be perfectly practicable; conscious of the attention this singular passage must excite, Mr. Rickman has in the preface addressed himself to an explanation of the matter.

"Mr. Telford's disapprobation of railroads, may perhaps be inferred too strongly from his objection to that which was first proposed between Birmingham and Liverpool in the year 1825 (see page 86 of this volume), so that some explanation is necessary on the subject. Mr. Telford's objection against railroads was not directed against the utility of a rapid conveyance of travellers; but merely against them as a rival conveyance of heavy goods usually carried on canals; and in this he has been fully justified by experience. The original prospectus of the Liverpool and Manchester Railroad estimated the expected profits of

the Company to arise from the daily carriage of 3,850 tons weight in heavy articles, and 100 tons weight only from the conveyance of passengers; whereas the result has been, that in the year 1833, the gross profit arising from the carriage of goods and Irish cattle, amounted to 22,057*l*; from the conveyance of passengers, to 51,897*l*. Mr. Telford, often expressed an opinion that the wear of engines and rails would be so considerable, that the expense of carrying coals and heavy merchandize must be greater on railroads than on canals, and he used to instance the Shropshire Canal, on which one horse frequently draws twenty boats, each laden with seven tons of coals, the average number of such boats being twelve, laden with 84 tons. Previously to Mr. Telford's death, it never was contemplated to construct extensive lines of railroads, for the sole purpose of conveying passengers; heretofore (as already stated) it was presumed and calculated that large quantities of goods would also be carried; whereas, it is now generally admitted that goods which do not require very speedy conveyance for special purposes, cannot be profitably carried on the railroads which have adopted a rapid locomotive power."—preface, p. xxi.

Mr. Rickman has here made out as good a case as possible, under the circumstances: but the grounds of his explanation will not bear a close examination. "Previously to Mr. Telford's death," the Liverpool and Manchester Railway had been four years in operation, with what result Mr. Rickman's own paragraph, relating to the year 1833 (the year preceding that event) will inform us. If, therefore, Mr. Telford never regarded railways as media of rapid conveyance, the whole affair becomes still more extraordinary. In a passage we have not quoted, Mr. Rickman goes on triumphantly to display Mr. Telford's feeling as to railways, by stating that he actually made surveys of various lines, and thus demonstrated that he had no hostility towards them. Unluckily, however, we are told that these railways were all for the conveyance of coals and heavy articles; if, therefore, Mr. Telford's approbation of them is to be inferred from his executing the surveys, what are we to think of Mr. R.'s hypothesis as to his *dis*-approbation extending only to their adaptation as a means of heavy conveyance? Besides, it is known that *many years* ago Mr. Telford wrote in *recommendation of their adoption, in fitting situations, for similar purposes* with canals, for the carriage of ponderous goods. Railways have, it must be confessed, run counter to the anticipations of all who have ventured to play the prophet concerning them, their own projectors and constructors among the number; but it was little to be expected that Mr. Telford, with his vast experience, and writing, as we are led to believe, after railways had begun at least to display practically their powers of rapid transit, should have left on record so "strong" a "disapprobation" of an invention which marks a great epoch in engineering science; and, after all, we are afraid Mr. Rickman must be content to see the dictum of his friend registered as—coming from such a man, a "great psychological curiosity," if no more.

With the second part, Mr. Telford's own work ceases; the remainder of the volume consists of an Appendix, added by Mr. Rickman. Many of the papers composing this are exceedingly valuable, as filling up subjects, which in the text had been left too much in outline, and supplying in some degree a commentary on the body of the book. Most readers, however, will think the editor has been too liberal in this department, which, in point of quantity, is by far the largest division of the whole; now while they are grateful to Mr. Rickman for most of the additional information he has furnished, will they be unapt to fancy that he would have done better had he made a more sparing use of documents so easily attainable, and sometimes so unconsciously lengthy, as the Parliamentary Reports? In some measure, it must be owned, the tail is rather "too big for the body," the Appendix overlays the text.

With respect to the getting-up of the work, there is of course nothing to be desired, profit not being looked for, and whatever expense was at all necessary being defrayed from Mr. Telford's purse in his life time, and since his death, from his estate, under the direction of his executors. The plates, especially are executed in the first style, and they are on so large a scale as to show every particle of each subject clearly and distinctly, and in such a manner, that every dimension may be ascertained; a great point, we are informed, in the eyes of Mr. Telford, and for the accomplishment] of which he chose a size for his "Atlas,"

which otherwise might be considered inconvenient. The whole work is one which will form a welcome and indeed essential addition to every library where the useful arts find a place.

NICKELS'S NEW INDIA RUBBER FABRIC.

[Patent, dated March 15th; Specification enrolled, Sept. 1839.]

Waterproof cloth has been made with combinations of caoutchouc with silk, cotton, wool, and other fibrous materials, felted, woven, platted, plated, and in other ways. The present patentee adopts the plan of placing a series of strands or threads side by side, parallel to each other, and combining them into a fabric, by attaching them together by means of a solution of caoutchouc. Shellac, or other resinous varnishes, it is stated, may be used, instead of a solution of caoutchouc, to cause the longitudinal or parallel strands or threads to adhere together. Machinery for performing these operations is described by the patentee, as an exemplification of the way in which the invention is to be carried into effect. The thread is wound round a cylinder, the diameter of which shall be equal to the size of the sheet to be produced. The India rubber solution, or resinous varnish, is then spread over the helical coil of threads, the superfluous stuff removed, and when it has dried or set, the sheet has to be removed from the drum. A sheet of figured or ornamented silk, or other fabric, may be superadded to the sheet of caoutchouc cloth thus produced, which may be used for ladies' cloaks and other like purposes.

IMPOLICY OF THE DUTIES ON TIMBER, BRICKS, GLASS, PAPER, AND SOAP.

Sir,—Continued discussion of those numerous and important inventions and improvements which are so rapidly occurring cannot but be advantageous to the general welfare; and the direct and frequent information which scientific men and the public have an opportunity of gathering from your journal, renders the *Mechanics' Magazine* peculiarly valuable.

But, Sir, there are *other topics* which *may fairly claim attention, and admission to the columns of the Mechanics' Magazine*, and which in themselves are of equal value with the principles of matter and the extension of trade—namely, the acts of the legislature as they tend to improve or depress the national industry.

I would then, Sir, point to your notice, and to those engaged in these arts, manufactures, and commerce by which our country has attained her present commanding eminence among the nations of the world the following facts. The duty on Baltic timber imported, is nearly 70 per cent.! On bricks, there is an excise of about 25 per cent.! On paper nearly the same! On glass, and also on soap, the duties are very high.

The taxes on wool, cotton, and silk, are merely nominal, because these manufactures would be injured by the price of the raw material being enhanced. This is a wise policy, and ought to be extended to other branches of industry. It cannot be equitable, that whilst the spinners of wool, cotton, and silk, use their materials almost duty free, the equally useful industry of the carpenter, the brickmaker, and the printer, should be loaded with duties unknown in any other part of Europe.

The effect of this partial legislation, Sir, cannot but be considered as a great national grievance, and one which a wise government, I should think, would feel deeply interested in removing.

Your humble servant,

H. Brown.

ALTERATION IN THE BRICK DUTIES.

By the 2d and 3d Victoria, cap. xxiv. the duties upon bricks are considerably lowered, especially upon bricks of a larger size than usual, and of irregular shapes. The duties at present are, "for and upon every thousand bricks, of a size not exceeding 150 cubic inches each brick, which shall be made in Great Britain, or which shall be brought from Ireland into Great Britain, a duty of 5s. 10d.

"For and upon every thousand of bricks, exceeding the foregoing size, which shall be made in Great Britain, or which shall be brought from Ireland into Great Britain, a duty of 10s.

"For all bricks made in Great Britain on which the duties imposed in respect thereof shall have been charged, and which shall be duly removed to Ireland or exported to foreign parts as merchandize, a drawback of the duties paid."

The other principal provisions of the act are—

That all bricks shall be charged with duty whilst such bricks shall be in the operation of drying or hardening in the field, &c.

In charging the duty on bricks, ten per cent. to be allowed for waste.

Bricks shall be placed in such form that the officer may readily and securely take an account of them; and penalty for placing them irregularly.

"Bricks may be made of such a shape that it may be difficult to ascertain with accuracy the true cubical contents thereof, whereby doubts or disputes may arise whether such bricks are subject to the higher or to the lower rate of duty imposed by this act; be it therefore enacted, that every maker of bricks shall provide, to the satisfaction of the supervisor of excise, a mould adapted and proper, and similar to the moulds in ordinary use by such maker, for forming and turning out a brick ten inches long, three inches thick, and five inches wide; which mould, when approved of by the supervisor of excise, shall be stamped or branded by him with the word "excise," and shall be delivered into the custody of such maker, to be by him kept for the use of the officer surveying such maker of bricks; and if any dispute shall arise as to whether any bricks, the cubical contents of which may be difficult to ascertain, are of a greater size than 150 cubic inches, and so subject to the higher rate of duty, the officer of excise shall take indifferently from the quantity of bricks the size whereof shall be disputed three bricks, and shall press the clay composing each of such three bricks into the said mould and turn the same out as a brick; and if upon such three trials any two of such bricks, or the clay composing the same respectively, shall not be more than sufficient to fill such mould, and form a brick of the dimensions of ten inches long, three inches thick, and five inches wide, the whole of such bricks shall be deemed and taken to be bricks not exceeding 150 cubic inches, and subject to the lower rate of duty; but if any two of such bricks, or the clay composing the same respectively, shall be more than sufficient to fill such mould, so that a larger brick than of the dimensions aforesaid would be produced if the whole of such brick or the clay composing the same were pressed into a mould of sufficient capacity to receive the whole of such brick or clay, then the whole quantity of the bricks in dispute shall be deemed and taken to be bricks exceeding 150 cubic inches, and subject to the higher rate of duty, and shall be charged with duty accordingly."

"*In order to prevent* the duties hereby imposed *from being evaded by bricks being denominated tiles, it is enacted, that nothing shall be deemed or taken to be a tile which* shall not, when turned out of the mould (except tiles for covering houses or buildings or draining lands,) be a perfect square, or which shall, when so turned out, be of greater thickness in any one part than one inch and seven-tenths of an inch, if under eight inches square, or of greater thickness in any one part than two inches and a half if more than eight inches square, or which shall have any incisions made therein so as to allow of being easily separated or divided after being burned. It shall be lawful for the Commissioners of Excise to determine that tiles made otherwise than square, shall not be considered as bricks chargeable with duty, on being satisfied that the same are intended to be used solely as tiles."

Bricks made for the sole purpose of draining wet and marshy land, are exempt from duty.

RUTHVEN'S PATENT STEAM BOILER.

From a letter which appears in the *Edinburgh Chronicle* we extract the following remarks upon Steam Boilers by Mr. Ruthven, of Edinburgh, (the Patentee of the Rotary Steam Engine, and other improvements in steam power) and description of a boiler which he has recently patented (March 20th, specification enrolled in September):—

From a late publication on steam-boilers, by Josias Parker, Esq., C.E., it appears that the construction or form of a boiler for generating steam is of the greatest importance, as it is to the boiler we must look for safety, power, durability, and economy of fuel. In a letter addressed to the President of the Institution of C.E., by Mr. Ham of Norwich, C.E., he states, "I am moreover confident, that were slower combustion practised, fewer explosions, and a mere tithe of the present destruction of boilers, would result, independently of its effecting a considerable saving in fuel, which would most amply repay for the capital invested in extra boiler room." Mr. Ham is here alluding to non-condensing engines, and he is undoubtedly correct, that the intense heat employed under the boiler, by large fires, is subversive of the intention, and "that when the boiler is highly heated, the water is actually repelled from the surface of the plates, by an atmosphere of caloric, from its not being able to absorb it with sufficient rapidity,"

I shall now state how far I have obtained these desirable objects:—I adopt a round boiler, about two feet diameter, and any required length; this form gives a strength that will sustain, with three-eighth plates, upwards of 800lb, pressure per square inch; but the great desideratum, *surface*, is wanting; this I have gained by forming into a spiral from 500 to 1000 feet, or more, (ac-

cording to the size of engine) of malleable iron pipe, of an inch diameter, more or less, as required; this spiral represents a still-worm of from 12 to 15 inches diameter; it is placed in the flue leading from the fire, and through which the heated air must pass in its way to the chimney; one end of the spiral is connected with the boiler under which the fire is placed, the other end is attached to the pump for supplying the water. I thus expose the whole surface of the spiral in the flue to the action of the heat passing through and around it, while the water is extracting the caloric in its passage to the boiler, the heated air passes into the chimney, where the coldest of the water enters the spiral, and before the water enters the boiler, it is ready for converting instantly into steam. Besides the objects stated by Mr. Ham, I may add, that this arrangement gives strength, durability, and economy, with more security from steam power than has yet been obtained, and it is hoped may restore that confidence so necessary, particularly in steam-vessels and locomotive engines.

SECRETARYSHIP OF THE SOCIETY OF ARTS.

A meeting of this Society was held at the Adelphi, on Wednesday evening last, at half-past seven o'clock, as advertised, to receive the memorials and testimonials of such candidates as might offer themselves for the office of Secretary. After some discussion as to the mode of procedure, the several gentlemen were called in, in alphabetical order, according to the initial letter of their names, read their memorials and delivered their testimonials to the Secretary, by whom they were read to the meeting. The candidates were eleven in number, viz.:—Mr. Baddeley, mechanist; Mr. Bridge, gentleman; the Rev. Professor Dewhurst, surgeon, &c.; Mr. Duncan, architect; Mr. Graham, teacher of mathematics and languages; Mr. Grover, surgeon; Mr. Kerridge, of Trinity College, Cambridge, tutor; Mr. Keay, a gentleman who had been in the four quarters of the globe; Mr. Poole, architect and surveyor; Mr. Warne, Assistant-Secretary to the Marylebone Female Penitentiary; and Mr. Williams, Secretary of the Mathematical Society. All these gentlemen are, doubtless, more or less qualified for the office which they seek; and the recommendations which they severally produced, were highly flattering to their characters and attainments in all points, except those which are most requisite for the due performance of the duties of Secretary of a scientific-institution, with the three exceptions *of those presented by Mr. Baddeley, Mr. Graham,* and *Mr. Williams. Professor Dewhurst delivered in a folio volume of testimonials,* which, to have gone through, would have occupied until the present hour; from those which were read by the Secretary, they appeared to be certificates of attendance at various academic courses of lectures on anatomy, surgery, materia medica, cupping, midwifery, &c., as well as every letter of commendation or thanks for the delivery of lectures, or presentations of printed copies thereof, which he has received for the last twenty years. The Professor was requested to retire, and to pick out about a dozen which he thought most suited to the occasion; but, on being again called upon, it was announced that he had departed. Mr. Poole delivered in no testimonials, not knowing that they were necessary, his only knowledge of the vacancy of the office being derived from the advertisement in the *Times*. He was allowed until Tuesday next to deliver his recommendations.

It was evident to all present that the contest will be between the first and last of the gentlemen named, Mr. Baddeley and Mr. Williams. Mr. Graham has little, if any, chance of success; but he will, probably, be third on the poll. Amongst the high testimonials produced by Mr. Baddeley, we may mention one voted to him by the Committee of the London Mechanics' Institution. Mr. Williams was also strongly spoken of in a testimonial from the Mathematical Society, as well as in numerous other certificates which he delivered—but his attainments, although high, seemed to be of too peculiar a nature; they were principally confined to mathematics, numismatics, and conchology. Mr. Graham's claims rested upon his knowledge of various languages, and his general attainments. He was recommended particularly by Lord Minto, and by Sir Charles Adam, of the Admiralty, to whose children he had filled the office of tutor.

At the close of the introduction of the various candidates, a discussion arose as to whether the memorials and testimonials should be referred to a Committee, to examine them and the candidates, and report whom, from amongst the number, they deemed qualified, or whether this should be decided at once by the meeting. A division took place upon the question, and the reference to a Committee was carried by a large majority.

The meeting was numerously attended, and the proceedings occupied until nearly midnight.

We take this opportunity of mentioning, with great pleasure, that at the last meeting of the Society, a gold medal was voted to Mr. Aiken, with a suitable inscription to be afterwards decided upon, on the occasion of his retirement from the office of Secretary; he was also elected an honorary member

life. We sincerely wish that he may long live to honour the Society with his connection; and we are sure that it adds greatly to the dignity of the office to which the present candidates aspire, to know that it was filled by so talented, and so estimable a predecessor.

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 24th OCTOBER, AND THE 26th NOVEMBER, 1839.

Stephen George Dordoy, of Blackman-street, Borough, chemist, for certain improvements in the manufacture of gelatine size and glue. Patent dated October 31; six months to specify.

David Greenwood, of Liverpool, millwright, and William Pickering, of Liverpool, merchant, for improvements in engines for obtaining power. November 2; six months.

Samuel Morand, of Manchester, merchant, for improvements in machinery for stretching fabrics. November 2; six months.

Theobald Wahl, of George-yard, Lombard-street, engineer, for improvements in boilers applicable to locomotive and other engines. November 2; six months.

Alexander Angus Croll, of Greenwich, manufacturing chemist, for improvements in the manufacture of gas, and in re-converting the salts used in purifying gas, and improvements in the manufacture of ammoniacal salts. November 2; six months.

John Cutten, of Margate, coal merchant, for improvements in garden pots. November 2; six months.

William Hannis Taylor, of New York, but now of Bridge-street, Blackfriars, Esq., for improvements in obtaining power by means of electro magnetism. November 2; six months.

Frederick Augustus Glover, of Charlton, near Dover, clerk, for an improved instrument for the measurement of angles. November 2; six months.

Henry Venner Cocks, of Birmingham, iron-founder, for certain improvements in stoves and furnaces. November 2; six months.

Henry Crosley, of Hooper-square, Leman-street, engineer, for an improved battery or arrangement of apparatus for the manufacture of sugar. November 7; 4 months.

James Murdoch, of Great Cambridge-street, Hackney-road, mechanical draftsman, for certain improvements in marine steam engines. November 7; six months.

Thomas Yates, of Bolton-le-Moors, manufacturer, for certain improvements in the construction of looms for weaving, and also the application of the same, in order to produce certain descriptions of goods or fabrics by steam or other power. Novemmber 7; six months.

George Hanson, of Huddersfield, plumber and glazier, for certain improvements in the construction of cocks or taps for drawing off fluids. November 7; six months.

Thomas Whiteley and John Whiteley, of Stapple-ford, near Nottingham, lace makers, for improvements in warp machinery. Nov. 7; six months.

John Thomas Laurente Lamy Godard, of Christopher-street, Finsbury-square, merchant, for improvements in looms for weaving, to be worked by steam or other power (being a communication). November 7; six months.

John Jones, of Westfield-place, Sheffield, for an improved table knife. November 7; six months.

Edmund Moody, of Maiden Bradley, Wilts, yeoman, for improvements in machinery for preparing turnips, carrots, parsnips, potatoes, and all other bulbous roots, as food for animals. November 7; six months.

Thomas Edmondson, of Manchester, clerk, for certain improvements in printing presses, November 9; six months.

James White, of Lambeth, engineer, for improvements in machinery for moulding clay to the form of bricks and tiles, and also for mixing, compounding, and moulding other substances. November 12; six months.

William Chesterman, of Burford, engineer, for improvements in stoves. November 12; six months.

Moses Poole, of Lincoln's-inn, gentleman, for improvements in making nails, bolts, and spikes (being a communication). November 12; six months.

Moses Poole, of Lincoln's-inn, gentleman, for improvements in looms for weaving. November 12; six months.

William Wiesmann, of George-yard, Lombard-street, merchant, for improvements in the manufacture of alum (being a communication). November 16; six months.

John Burn Smith, of Salford, cotton spinner, for certain improvements in machinery for preparing, roving, spinning, and twisting cotton and other fibrous substances. November 16; six months.

Miles Berry, of Chancery-lane, for an invention or discovery by which certain textile or fibrous plants are rendered applicable to making paper and spinning into yarns, and weaving into cloth, in place of flax, hemp, cotton, and other fibrous materials commonly used for such purpose (being a communication). November 19; six months.

Francis Worrell Stevens, of Chigwell, schoolmaster, for certain improvements in apparatus for propelling boats and other vessels on water. November 19; six months.

John Parsons, of the Stag tavern, Fulham-road, victualler, for improvements in preventing and curing smoky chimneys. November 21; six months.

John Farand, of Middlewich, Chester, gentleman, for certain improvements in the mode of constructing, applying, and using railway switches for connecting different lines of railway, or two distinct railways; and for passing locomotive, steam, and other engines and railway carriages and waggons, from the one to the other of such railways, and for certain apparatus connected therewith. November 21; six months.

Robert Hawthorn and John William Hawthorn, of Newcastle-upon-Tyne, civil engineers, for certain improvements in locomotive and other steam-engines in respect of the boilers and the conveying of steam therefrom to the cylinders. November 21; six months.

Pierre Auguste Ducote, of St. Martin's-lane, for certain improvements in printing china, porcelain, earthenware, and other like wares, and for printing on paper, calicoes, silks, woollen, oil-cloths, leather, and other fabrics, and for an improved material to be used in printing. November 21; six months.

William Daubney Holmes, of Lambeth-square, C. E., for certain improvements in the construction of iron ships, boats, and other vessels, and also in means for preventing the same from foundering, also in the application of the same improvements; or parts thereof to other vessels. Nov. 23; six months.

John Hunt, of Greenwich, engineer, for an improved method of propelling and steering vessels. Nov 23; six months.

Richard Hornsby, of Spittlegate, Lincoln, agricultural machine maker, for an improved machine for drilling land, and sowing grain and seeds of different descriptions, either with or without bone or other manure. Nov. 25; six months.

John Sutton, of John-street, Lambeth, machinist, for improvements in obtaining power. Nov. 25; six months.

James Craig, of Newbattle Paper Mill, Edinburgh, for an improvement or improvements in the machinery for manufacturing paper. Nov. 25; six months.

Arthur Collen, of Stoke, by Hayland, plumber, for improvements in pumps. Nov. 25; six months.

James Matley, of Manchester, gent., for improve-

ments in apparatus or instruments for the cutting of cotton, or the wicks of lamps. Nov. 25.

George Rennie, of Holland-street, Blackfriars, C. E., for certain improved methods of propelling vessels. Nov. 26; six months.

LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 22D OF OCTOBER AND THE 22D OF NOVEMBER, 1839.

Alexander Borland, of Paisley, Renfrew, accountant, for a machine for measuring water and other liquids, and registering the quantity thereof. Sealed 26th of October, 1839.

James Smith, of Deanston Works, Kilmadock, Perth, cotton spinner, for certain improvements applicable to canal navigation. Oct. 26.

George Chapman, of Whitby, York, Engineer, for certain improvements in steam-engines. Oct. 26.

Samuel Wilks, of Darleston, Stafford, iron founder, for improvements in boxes and pins, or screws for vices and presses. Oct. 28.

Thomas Nicholas Raper, of Bridge street, Blackfriars, London, for improvements in rendering fabrics and leather water-proof. Oct. 28.

Robert Edward Morrice, of King William-street, London, gent., (communication from a foreigner) for improvements in the manufacture of boots and shoes, and coverings for the legs. Oct. 28.

James Smith, Deanston Works, Kilmadock, Perth, cotton spinner, for a self-acting temple, applicable to looms for weaving fabrics, whether moved by hand or power. Nov. 1.

James Yates, Effingham Works, Rotherham, York, iron founder and earthenware manufacturer, for certain improvements in the construction of cupola or blast furnaces for melting metals, which improvements are also applicable to furnaces or fire-places for other purposes. Nov. 1.

John Barnett Humphreys, of Southampton, C.E., for certain improvements in shipping generally, and in steam vessels in particular; some of these improvements being individually novel, and some the result of novel applications or combinations of parts already known. Nov. 1.

John George Bodmer, of Manchester, Lancaster, C. E., for certain improvements in machinery, or apparatus for cutting, planing, turning, drilling and rolling metals and other substances. Nov. 8.

William Newton, of Chancery Lane, Middlesex, C. E., (communication from a foreigner) of certain improvements in machinery or apparatus for making, or manufacturing screws. Nov. 11.

James Sutcliffe, of Henry-street, Limerick, builder, for certain improvements in machinery, or apparatus for raising and forcing water or other fluids, and increasing the power of water upon water-wheels and other machinery. Nov. 11.

James Ulric Vancher, of Mount-street, Grosvenor-square, Middlesex, for certain improvements in fire-engines and other hydraulic machines, and apparatus for raising or propelling water and other fluids, some of which improvements are also applicable to steam-engines. Nov. 11.

Moses Poole, of Lincoln's Inn, Middlesex, gent, (communication from a foreigner,) for improvements in apparatus applicable to steam boilers, in order to render them more safe. Nov. 11.

James Craig, of Newbattle Paper Mills, Newbattle, Edinburgh, for an invention of an improvement or improvements in the machinery for manufacturing paper. Nov. 12.

Pierre Auguste Ducote, of No. 70, St. Martin's Lane, Middlesex, for certain improvements in printing china, porcelain, earthenware, and other like wares, and for printing on paper, calicoes, silks, woollens, oil cloths, leather, and other fabrics, and for an improved material to be used in printing. Nov. 14.

John Dickinson, of Nash Mill, Hertford, paper-maker, for certain improvements in the manufacture of paper. Nov. 16.

George Hanson, of Huddersfield, York, plumber and brazier, for certain improvements in the construction of cocks or taps for drawing off liquids Nov. 19.

William Wiesman, of George Yard, Lombard-street, London, merchant, (in consequence of a communication from a certain foreigner residing abroad, and partly by invention of his own,) for improvements in the manufacture of Alum. Nov. 22.

Charles Andrew Caldwell, of Audley-square, Middlesex, Esq. (communication from a foreigner residing abroad) for improvements in furnaces and apparatus for supplying the heat of fuel. Nov. 22.

Frederick Clark, of Chelsea, Middlesex, (communication from a foreigner residing abroad) for improvements in building ships steam-vessels, and boats, and also in the building of canal and river barges, and lighters. Nov. 22.

LIST OF IRISH PATENTS GRANTED IN OCTOBER, 1839.

J. Templeton and W. Quiglay, for a new improved mode of manufacturing silk, cotton, and linen fabrics.

J. C. Miller, for certain improvements in printing calicoes, muslin, or other materials. Oct. 4.

R. Griffiths, for certain improvements in presses, which are also applicable to the raising of weights. Oct. 8.

D. Johnston, for certain improvements in the manufacture of hinges.

J. Burch, for certain improvements in printing cotton, woollen, paper, and other fabrics and materials.

NOTES AND NOTICES.

Electro Magnetism as a Motive Power.—Dr. Jones, Editor of the *Journal of the Franklin Institute*, in noticing a patent recently granted in America for an Electro Magnetic Engine, observes,—It has been satisfactorily ascertained by numerous and well-conducted experiments, in the hands of persons of competent scientific knowledge, that the attainment or an available motive power by the electro magnetic influence, is a thing not to be hoped for, in the present state of our knowledge upon that subject; and that although we have much to learn concerning this agent, we have no ground, by reasoning from what we do know, to justify the hope that the steam-engine will eventually give place to the electro magnetic power. After this it is hardly necessary to remark that all the instruments hitherto constructed for this purpose have proved to be failures, so far as practical utilitarianism is concerned. That before us depends for its action upon a change of poles, in a manner common to most of its compeers; but it was thought that the particular arrangement of the parts, presented sufficient novelty upon which to base a claim, and a patent was therefore granted for it; but this will not protect it from the fate which has overtaken, or awaits, the whole brotherhood. A year ago, applications for patents, were numerous, and many caveats were entered, for the purpose of protecting the inventors of such machines, but many months have passed over, as we believe, without any new device having been offered, and we are glad of it, because we think that those who might be induced to continue such attempts for profit, would be destined to encounter certain loss.

Steam and Air Engine.—A gentleman of this town informs us, that he has invented a new engine, immensely superior in every respect to the old steam-engine. The power is created by air and steam. It will consume only one-half the quantity of fuel of the old one; and the rapidity by which a vessel propelled by it will sail will enable it to perform a passage to America in six days.

Owing to a particular way in which the power acts upon the vessel, 20 miles the hour can be realized with the greatest possible ease. The weight of machinery will be only one-half that required by the old steam-engine, and, instead of straining and weakening the ship, will brace and strengthen it. By this method the steam power is more than doubled.—*Liverpool paper.*

India Rubber Boat.—"There has just been launched on the Neva," says a St. Petersburgh letter, "an India rubber boat. It is made of sail-cloth, impregnated with caoutchouc. It may be rolled up, and in the space of ten minutes can be filled with air by means of four little cocks, by which inflation it assumes the form of a boat. During its trial on the river it held three persons and excited much attention, as well by the readiness of its movements as by its very pretty appearance."

Miller's Patent Fire-bars.—A patent has been taken out for a new fire bar, which is suited not only to the common steam-engine furnaces, but can with equal facility be applied to the furnaces of marine engines, and the locomotive engines of railways, &c. The principle of the invention consists in moving each alternate bar longitudinally in one direction, whilst the intermediate bars are moved in the opposite one. This movement, aided by the channelled surface of the bars, breaks up the clinkers the instant they are formed, or prevents their formation, and thus keeps the air way perfectly free. Considerable attention has, from time to time, been paid to the improvement of the fire-bar, now become of so much importance to the manufacturing community, by men eminently qualified, and several patents have been obtained for this purpose, all of which have been very considerable improvements over the ordinary fire-bar. The object of the inventors not being always the same, has produced a great variety of plans, which have had more or less merit. Brunton, and also Steel, with a view to an equal distribution of the fire, made the grate itself revolve; others have simply moved the fire-bars, with the intention of preventing the adhesion of clinkers, and the consequent obstruction of the air-way. This is the object of Miller's patent, which, being simple in its principle, of easy construction, not requiring extraordinary strength, and consequently no increased weight of metal, the object is attained with little increased expense over the ordinary fire-bar. The advantages it secures are very considerable; for not only, by the perfect freedom from all obstruction of the air-way, is the combustion of the fuel and its heating power considerably increased, but coal of an inferior quality can be used without the usual effect of choking up the grate. By the vigorous combustion which this grate ensures, it prevents large masses of coal from passing away unconsumed in the form of smoke, and consequently must effect a considerable saving in fuel. The ingenious patentee is the chief engineer of the extensive works of Messrs. Thomson, Brothers and Sons, Primrose, near Clitheroe, where these bars have been for some time at work, and have fully realised the expectations of the inventor. —*Manchester Guardian.* [The description of Mr. Miller's improvement here given is not very distinct; but it appears to us very much to resemble that patented by Mr. Walter Hancock for the same purpose. See Mr. Hancock's "Narrative of Twelve Years' Experiments," p. 92; or *Mech. Mag.* vol. 20, p. 67.—Ed. M. M.]

Machine for Propelling Carriages.—We understand that Mr. Boydell, who has a patent for an improved method of propelling carriages, will, at the request of some of the Staffordshire ironmasters, exhibit a machine propelled by manual power, on the 29th of this month, at the Himley Arms, Himley. Some time ago he made several experiments in the neighbourhood of Chester, when he showed the power of the principle by propelling several carts attached to the machine, and seventy persons riding, by one man's power, for a short distance, at the rate of half a mile an hour; a carriage itself, with two men working, at the rate of eight miles an hour; and one carriage attached, with seven persons riding, at the rate of about six miles an hour. By steam power there is no doubt any speed may be obtained, or any weight of load pulled forward; and it is confidently hoped that this principle of movement will do away with the necessity of making railroads only upon nearly a level, and that the same power which is now used to propel carriages on railways will take them up any inclination not exceeding one in thirty.—*Wolverhampton Chronicle.* [We should be much obliged, if Mr. Boydell would favour us with a description of his machine, and statement of the announced experiment.—Ed. M. M.]

New Method of Determining the Carbon contained in Cast-Iron and Steel.—The determination of carbon contained in cast-iron is easily accomplished, and with great exactness, by the following proceeding:—You take five grains of cast-iron, reduced to filings when the cast-iron is soft, or pulverised in a mortar when it is brittle, and mix it with sixty to eighty grains of chromate of lead, melted previously. You take away about a third or fourth of this mixture, and put it aside. To the remainder you add five grains of chlorate of potass, which contain the quantity of oxygen required to change the iron into peroxide; afterwards you introduce the threefold mixture into a tube of glass, similar to those for organic analysis, but which may be much shorter. Afterwards you add to this the portion of the mixture of cast-iron and chromate of lead, which had been put aside. Lastly, you adapt to the tube the common Liebig apparatus, for the analysis of organic substances. The portion of the tube containing the mixture without chlorate is heated, and when it is red-hot you begin to heat that part which contains the chlorate, and the fire thus is advanced successively, in proportion as the disengagement of gas diminishes. By this proceeding the cast-iron at first burns completely by the oxygen of the chromate, and only a small quantity of this gas escapes through the tube. Afterwards, the temperature becoming higher, combustion is finished by the chromate of lead, which, in melting, oxydates the last portions of cast-iron. It is convenient to envelope the tube with a sheet of copper, because at the end it is necessary to heat it very strongly in order to obtain a complete fusion of the chromate. The oxydation of the cast-iron is complete, as you may assure yourself, by grinding, after the combustion, the matter contained in the tube—not a particle of matter remaining which is attracted by the loadstone. The analysis is so easy that the whole proceeding is finished in less than half an hour. Of the perfect concordance of the results we may judge from the three following analysis, made on the same grey cast-iron obtained by the hot air process:—

1. Five grains have produced		0·582	of carbonic acid.
2. Five ditto	ditto	0·585	ditto
3. Five ditto	ditto	0·588	ditto

Carbon, therefore, 1st, 3·22; 2d, 3·23; 3d, 3·25. When the cast-iron contains sulphur not a trace of sulphuric acid is disengaged, all the sulphur remaining in the tube in the state of sulphate of lead. I assured myself of it by producing the combustion of the sulphuret of iron. With the chromate of lead alone not all the carbon is obtained; the chromate, by losing much oxygen, becomes less fusible, and the oxydation penetrates with difficulty to the centre of the grains of a somewhat thick cast-iron. —*Annales de Chimie.*

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 852.] SATURDAY, DECEMBER 7, 1839. [Price 3*d.*

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PARKIN'S PATENT CARRIAGE FOR DESCENDING HILLS.

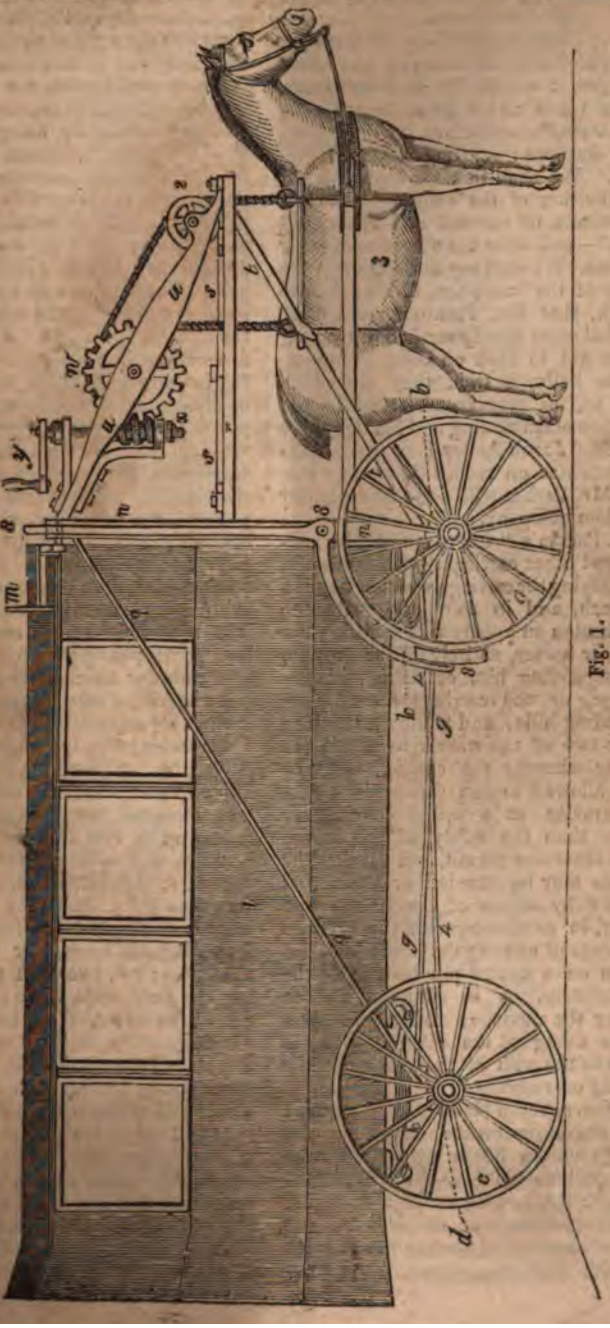


Fig. 1.

PARKIN'S PATENT CARRIAGE FOR DESCENDING HILLS.

[Patent dated 9th April—Specification enrolled October 9.]

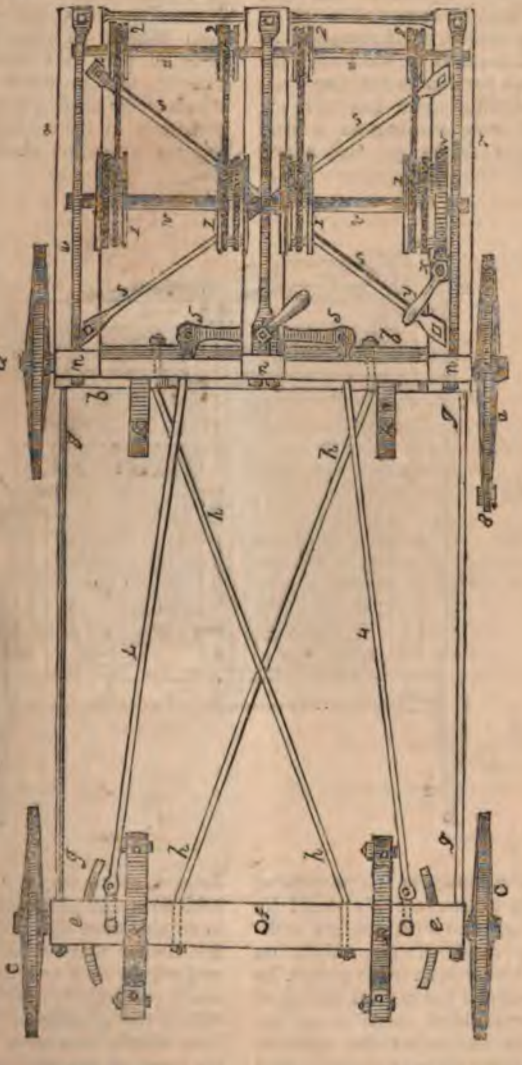
Mr. Thomas Parkin's patent for "improvements in railroad and other carriages, in wheels for such carriages, and in roads and ways on which they are to travel"—comprises, it will be seen, three divisions:—carriages, wheels and roads. We shall this week publish the first division of the subject—"the improvements in railroad and other carriages"—and defer the others to another occasion. We shall say nothing upon the merits of the invention, further than to remark, that Mr. Parkin should have specified some speedy method of training horses not to kick on being swung up by the belly, a trick they are much given to, as may be observed in the operation of embarking and landing these animals. Jacob Astley is at present the only patentee on record for horse training—Mr. Parkin will doubtless shortly keep him company.

Mr. Parkin's "improvements in railroad and other carriages" consist firstly, in modifying the carriage, whether waggon or coach, and in combining with the modification an apparatus for lifting the horse, or horses, entirely off the ground, and suspending him or them from the carriage, or the carriage frame, while descending hills; and adding a break to one or two of the wheels to retard the velocity whereby the carriage may be safely allowed to run down hill by its own gravity at a speed considerally greater than the safety of the horses would otherwise permit, and yet that the carriage may be retarded or stopped at pleasure by means of the break; and further, in combining with the carriage the means of causing the hinder axletree to turn on a centre pin instead of the fore axletree, as in common use for guiding the carriage; and in providing for the fixing of the axletree at right angles to the path of the carriage while running on railways."

"*Description of the Figures.*—Figure 1 (front page,) represents the profile of a carriage with a horse suspended from the apparatus placed at the front of the carriage; fig. 2, plan of part of fig. 1, *but with the body of the carriage and the horse omitted, in other* to show the frame work and apparatus, under and in front of the carriage more distinctly. Fig. 3, front elevation of fig. 1, with the horses omitted to show the apparatus more distinctly. The carriage, as represented in these three figures, is designed for being run on common roads, but I make a modification for exclusive use on such railroads as are unconnected with common roads, by fixing each pair of wheels upon one common revolving axle in the ordinary manner, and placing flanches on the inner side of the wheels to keep them from running off the rails, and I also remove the connecting rods, and fix the hinder axle parallel to the fore axle. The letters and numbers of reference signifying the same parts in all the figures, 1, 2 and 3. *a* represents the forewheels of the carriage, which are placed far forwards, in order that the weight of the carriage may have good leverage power for lifting the horses; *b*, the axletree of the front wheels; *c*, the hind wheels; *d*, the axletree of the hinder wheels; this axletree turns on a centre pin under a cross bar, upon which the springs of the carriage are bolted; *e*, the hinder cross bar of the carriage frame, under which the axletree *d* turns; *f*, the centre pin fixed in the cross bar; *e*, *g*, two iron rods holding the cross bar *e* and fore axle *b*, parallel to each other; *h*, two iron rods for the further bracing of the bar *e* and front axletree together; *k*, four springs for supporting the carriage body; *l*, the carriage body; *m*, the seat for the driver; *n*, an upright frame of wood affixed upon the front axletree; *p*, two iron diagonal braces to strengthen the frame *n*; *q*, two iron rods to support the top of the frame *n*, from the cross bar *e*; *r*, a horizontal frame projecting forwards from about the middle of the height of the upright frame *n*; *s*, two iron diagonal braces for strengthening the frame; *r s*[1], two iron rods for keeping the outer ends of the frame *r* at proper distances; *t*, three braces of wood for supporting the front end of the horizontal frame *r* from the axletree; *b a*, three strong bearing bars secured to the upper end of the upright frame *n* and to the front end of the horizontal frame; *r v*, a shaft lying across and revolving on the middle parts of the three bars *x*; *w*, a toothed wheel fixed on the end of the shaft; *v x*, a worm working in and driving the toothed wheel *w*; *y*, a spindle and winch for turning the worm;

z z, a shaft lying across and revolving on the front parts of the three bearing bars. *n* Four pullies 1, are fixed on the shaft *v*, to which eight ropes are fastened, four of which ropes hang down perpendicularly from the front sides of these pullies 1; the remaining four of the ropes pass and hang down perpendicularly from the front sides of the front pullies 2, on the shaft *z*. The

Fig. 2.

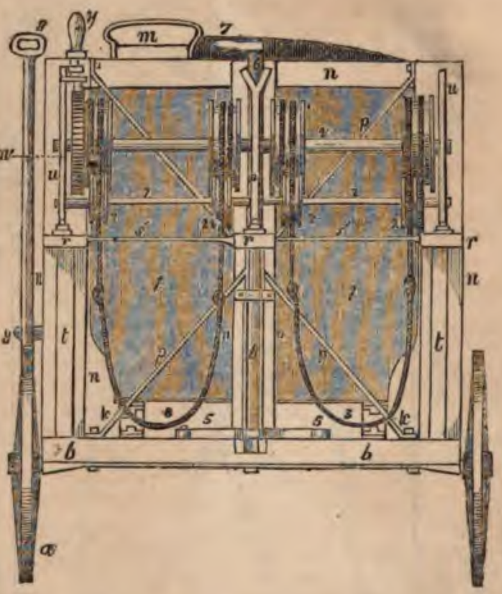


broad belts, are each secured by the four corners to two of the ropes hanging down from the pullies 1, and to two of the ropes hanging down from the front *pullies 2; each of these belts being designed to support a horse.* 4, two connecting rods for turning the hinder axletree. 5, two arms jointed with, and acting on the connecting rods 4. 6, an upright spindle carrying the two arms 5, and turning in bearings affixed to the upright frame p

and on the axletree *b*. 7, a lever, or handle, affixed on the upper end of the spindle 6, for turning the spindle, and thereby the arms, and by means of the connecting rods turning the hinder axletree and its wheels to guide the carriage; this handle may, by means of a spring catch of any ordinary construction be held in such position as shall keep the hinder axletree parallel to the fore axletree when running upon railways. 8, a break and lever turning on a stud in the upright frame *p*, and acting against the back of the fore-wheel of the carriage, the handle of the lever reaching up near to the seat of the driver.

Mr. Parkin states that he is aware that the lifting of a portion of the weight of a horse to ease his labour on descending hills has often heretofore been effected in carts by shifting the body of the cart backwards on the axletree, and in other cases by taking a part of the loading from the front and placing it at the back of the cart; and also that a method of lifting a portion of

Fig. 3.



the weight of a horse for the purpose of enabling him to increase his speed by striking the ground with his feet without pressing much of his weight on them, has already been made public, he therefore disclaims the partial lifting of a horse either on level roads or on declivities. But he claims the right of elevating the horse entirely off the ground on declivities down which the carriage can run by its own weight; this elevation of the horse being combined with *a break to regulate the* speed of the descent, or to stop the progress of the vehicle, at any part of the declivity; and in combination also with the turning of the hinder axletree of the carriage to make it go in a curvilinear direction as above particularly described. He further claims the placing of the axletree and fore wheels forwards, near or beyond the front of the carriage in this combination by which the weight of the carriage is thrown so far behind the horses as to more than counterbalance them when suspended.

ANOTHER FORMULA FOR CALCULATING THE SIDES OF RIGHT-ANGLED TRIANGLES BY THE SLIDING RULE.

Sir,—It is with great pleasure I have seen in your Magazine the able efforts of your correspondent, Mr. Woollgar, to bring into notice and to extend the power of that excellent and useful instrument of calculation, the sliding rule; an instrument, the value of which, I am sure, is far from being so well known and appreciated as it deserves to be.*

Having found out by experience its great use in checking, as well as in calculating problems of all kinds (involving multiplication or division), I was induced some time ago to make out for my own use, a complete set of formulæ for the solution of the most useful practical questions in trigonometry and mensuration, among which were the following two for calculating the lengths of the sides of a right-angled triangle, (the first problem given by Mr. Woollgar in your 849th number). They may not be perhaps quite so simple in practice as the one there shown, but they have this advantage, that they may be performed upon the common rule,* without the necessity of laying down any new line of divisions.

The first formula is for the trigonometrical lines of *Sines* (marked S), and *Tangents* (marked T), upon the back of the slide; the second for the lines A. B. C. D. alone.

1. Let a and b be the two legs, and C the hypothenuse; A. B. C. being the three respective opposite angles: it is well known that c : sin. 90° : : b : sin. B, and also that, tan. B : b : : tan. 45 : a, therefore, by finding *intermediately* this angle B, (or A as the case may require,) any side may be found when the other two are given, in the following manner:

A	b	a
Tang.	Angle B	45
A	b	c
Sines	Angle B	90

And it should be observed, that although two formulæ are required, yet, the factors all lying very nearly together under the eye, and all that is requisite to connect the two, being to carry with the eye the intermediate angle found, from one line to the next adjoining, the operation is almost as simple as if there were only one: a few trials will prove this.

2. The other formula is only adapted to the case where the *hypotheneuse* is one of the sides given, and it is merely an application of the well known theorem that "the product of the sum and difference of two numbers is equal to the difference of their squares." Thus, suppose c and b given to find a; then—

$$a = \sqrt{c^2 - b^2}, \text{ or } = \frac{\sqrt{(c+b)\,(c-b)}}{1}$$

which, adapted to the rule is—

A	$(c+b)$	
B	1	
C		$(c-b)$
D		a

The adding and subtracting of the two given sides which is here required, is such a trifling operation, that it may in almost all cases be mentally performed with sufficient accuracy while setting the rule.

If you think, Mr. Editor, that the problem above mentioned is one sufficiently useful to justify the publication of these additional rules for facilitating its solution, their insertion in your valuable work will oblige.

Hoping to see more numbers of the "The Calculator,"

I am, Sir,

Yours most respectfully,

WILLIAM POLE.

32, Windsor Terrace, City Road,
Nov. 22, 1839.

* *Erratum* in Mr. Woollgar's letter in No. 849—At p. 101, last line, for "1.049"—read "1.04q."

* I should perhaps state, that by the common rule, I mean the one laid down by Mr. Bevan, and sold by most of the opticians in London. This being, I believe, the one *most generally* used for the *purposes of calculation.*

MOODY'S METHODS OF PREPARING HIDES FOR MILITARY ACCOUTREMENTS, AND PREPARING FIBRED FLOCK FROM MILLED WOOLLENS.

Sir,—In the year 1812, the late Mr. Alexander Moody, an extensive paper maker at Hawley Mills, near Dartford, in Kent, entered a caveat for a new mode of preparing hides for soldiers' accoutrements, &c., and meant as an improved substitute for the usual species of buff, or losh leather, hitherto used for that purpose. The specimens he produced, considering them as a first experiment, went

far to create in his favour a very striking probability of success. The first hides he thus brought to maturity were inspected by his late Royal Highness the Duke of York, accompanied by his then secretary, the present Lord Bloomfield, who both testified their highest approbation of the colour, brightness and texture of the articles, beyond those dressed by the other method; both kinds underwent a critical examination in contrast with others on the score of merit. Mr. Moody's hides had been brought to perfection, without having been subjected to the severe process of milling, which never fails to impair, in a great degree, the strength, closeness and fine surface of the animal substance; his specimens were compact and firm, of a beautifully clear bright colour, and previously to their being inspected by the above leading personages, they had been looked at by many of the best judges in the trade, and they unanimously gave the preference to his hides beyond the others, by the old method. The Duke of York was so highly pleased with their handsome appearance, that he expressed it as his determined intention that they should be adopted speedily by the army at large. The health of the soldiers too was an important consideration. It is well known that soldiers are subject to severe colds and ailments, owing to their accoutrements, which are made of a spongy porous leather, imbibing and retaining a great deal of wet. This defect, and it is a serious one, Mr. Moody's new species of buff leather, will totally remedy; but there was one drawback, and one only, (which he intended, had he lived to have remedied,) viz., a slight stain was communicated by its coming in contact with the soldiers regimentals in wet weather; this alone prevented the ingenious inventor from reaping an equivalent reward. Having myself inspected the hides in company with the late Mr. Beddome, tanner, I feel no hesitation in saying, supported as I am by that gentleman's superior testimony, that Mr. Moody's new method of manufacturing buff leather was an evident improvement upon the old one, barring the one defect which I have mentioned, and it is a pity he did not live to mature his laudible industry.

While my pen is in hand, I beg to mention another ingenious attempt of his, of manufacturing an open fibred flock out of hard milled woollen rags; this he effected by means of powerful pressure between smooth plates, in an engine; whereas, the only method known of converting milled woollens into flocks, is by grinding their substance down, by the same process as reducing paper stuff into pulp. I am sorry to say, that Mr. Moody was snatched from this sublunary world just as many of his most useful ideas were expanding into fructification.

I remain, Sir, your obedient servant,

ENORT SMITH.

IMPROVED SHOP-SHUTTER CASE.

Sir,—Herewith I take the liberty of sending you the description of a plan which suggested itself to me several months ago, and having given it a careful examination, I am confirmed in the opinion, that its adoption would be of public utility. It is a design for an improved shop-shutter box, to be sunk into the ground, and with its suitable lid let in flush with the pavement. It has a moveable bottom or tray, which, with all the shutters, except one, (when in the box,) is balanced by four equal and suitable weights passing over pullies and working in corresponding grooves. In putting the shutters away in the morning, they are to be placed, one after another upon the moveable bottom or tray, (which, having no load, will be near the surface,) and will remain stationary until the last shutter is put into its place, when the weight of shutters preponderating will cause the whole to descend. The cover is then dropped into its place, and closes flush with the pavement, thus concluding the process. On shutting up, the reverse takes place; the lid or cover is first raised, and, then one shutter; the rest will follow by the preponderance of the weights, rising gently and perpendicularly into the street, instead of being shot as they too often are, at the unconscious passers by out of a cellar window. At night when the shutters are out of the box, the moveable bottom lies immediately under the cover, so that it cannot be employed as a refuge for disorderlies, as in most cases the weight of one person would not be sufficient to depress the bottom, or the lid may be fastened by a lock for perfect security.

I am yours most respectfully,

WM. JONES.

Manchester, July 20, 1839.

GAS METER REGULATOR.

Sir,—Allow me through the medium of your Magazine, to suggest the following improvements, to the manufacturers of gas meters:—

To the interior works of a meter, attach a balance and escapement, which will prevent the meter revolving quicker than may be necessary to give a good supply of gas to each burner connected with it. The escapement might be made similar to those in watches, and also regulated as easily, although when once done properly it would not require altering. Thus the escapement would check the evils that arise from changes of pressure, serving the same purpose as Bacon's Patent Moderator, described at page 98, with the advantage of being combined with the meter, and at a very inconsiderable increase of price over the common ones.

E. F.

Brighton, Nov. 26.

FRENCH PATENTS.

In France it is the practice for an applicant for a patent to lodge a description of his invention sealed, and from the day of this deposit, his right, as against all after applicants, is secured. These descriptions, or "*Memoirs descriptif*," as they are termed, are taken in turn, and examined by a *Commité Consultatif*, and the patent either granted, or the inventor recommended to withdraw his application. He may, however, demand his patent notwithstanding this recommendation, and it will be delivered to him at his own risk.

This mode of proceeding certainly is far more just in principle than that followed in Britain; but the recent practice has rendered it extremely vexatious to inventors and patentees. A correspondent from Paris informs us that he lodged a demand for a patent eight months ago, and he has not yet received the "*Certificat de demand*." He "attended at the office to ascertain the reason, and found that the packet of documents had not yet been opened by the consulting committee, but was lying along with a large mass of applications in the same state, some of which had been deposited in December last, so very numerous are the patents which are now continually taking out, and so very niggardly is the economical spirit of the administration, that they will not put on extra hands to do the extra work, but allow it to accumulate in the manner just mentioned, to the great inconvenience of the public."

Our experience in the matter, in a great measure confirms the statement of our correspondent, although we have no applications so long in abeyance as since December last, and we think that there must be some other than the ordinary causes of delay to arrest the progress of those referred to. We trust the French government, who are generally so attentive to the advancement of matters of science and manufacture, will make an alteration in this state of things, and appoint additional officers to meet the increased business—otherwise the evil will mend itself in a way not so favourable to the French industry. Inventors, and particularly importers of patents, will cease to apply, where there is so great uncertainty and delay in obtaining their right; as they cannot of course take any active steps towards the sale or working of a patent until they know of its security. Circumstances too, alter, and occurrences take place in the course of time, which might render an invention which is invaluable to-day, worthless to-morrow.

There is hardly any vexation equal to the vexation of delay;—opposition you may meet and overcome, but the laggard steps of tardy officials and formal processes you cannot hasten. We do not accuse any of the gentlemen constituting the present *commité* of neglect—far from it—we believe that they have used every exertion to get through the accumulated mass of *memoirs*. We hope soon to hear that some competent members have been added to their number—and that the anxious inventors who have been so long been kept waiting in suspense, will speedily know their fate. Finally, we would observe, that it is the interest of the government, both directly and indirectly—for the sake of their treasury—and of the industry of the kingdom, rather to facilitate than throw obstructions in the way of native inventors, and importers of foreign inventions.

STOCKER'S PATENT COCK.

[Patent dated May 13; Specification enrolled Nov.]

Fig. 1.

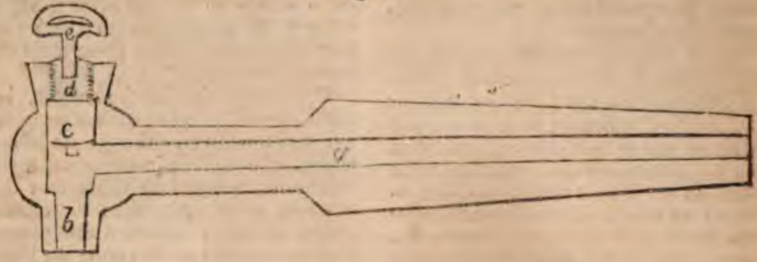
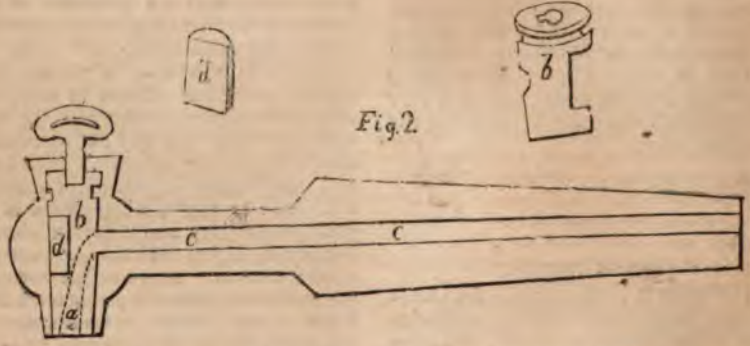


Fig. 2.



The object of the patentee is to prevent the leakage to which cocks are liable, by the use of an elastic plug or stopper; fig. 1, is a section of the improved cock; *a*, the passage for the liquor to pass from the barrel; *b*, the mouth or nose of the cock; *c*, an elastic substance or cork rivetted to the screw plug, *d*; this screw plug when turned by the handle *e*, presses the cock *c* over the passage *a*, and down upon the bearing just above the mouth *b*.

Fig. 2, is another view of the mouth-piece. The mouth, or orifice, *a*, in the plug *b*, is placed opposite the passage *c*, through which the liquor passes; the elastic substance or cork *d*, is fitted in the plug, which, when turned round by the handle, presses on the passage *c*—thus preventing the possibility of leaking.

PATENT PADDLE-WHEEL CASE—GALLOWAY AND ANOTHER *v.* BLEADEN.—(NOV. 30.)

On Saturday last this important case was tried in the Court of Exchequer, before Lord Chief Baron Abinger and a special jury. We are happy to see so evident a desire to support patentees in their rights, as that evinced by his lordship in his summing up. It will tend to give greater confidence to capitalists to embark in the prosecution of important discoveries, when they see the legal tribunals leaning rather towards *than against them* in the support of their *property—as, in fact, all judges are enjoined to do, in the terms of* the patent.

Mr. Galloway's patent wheel, the subject of the trial, was described in the *Mechanics' Magazine*, vol. xxiv, p. 241. See also further particulars, vol. xxviii, p. 363.

Galloway v. *Bleaden.*

The case on the part of the plaintiffs was, that Mr. Galloway had invented an improved paddle-wheel for propelling steam-vessels, for which he obtained a patent on the 18th of August, 1835. The invention consisted in a division of the floats into segments, and so arranged in a cycloidal curve as to cause all the five or six segments into which each float was divided to enter the water at the

same time and at such an angle as most diminished the shock occasioned to the vessel by each stroke of the paddle; whilst the segments, when the float reached a vertical position in the water, became joined together as it were, so as to present an undivided surface to the water, and so increase the power of propulsion; and lastly, the float, when passing out of a vertical position, by becoming again divided, offered less resistance to the back water, and, consequently, less retarded the speed of the vessel than if undivided. The action was brought against the defendant, as secretary to the Commercial Steam-packet Company, for an infringement of this patent; to which he pleaded, in addition to the general issue of not guilty, that the invention was not new, as it had already been discovered and used by Mr. Field in 1833; and that the specification wast not sufficiently intelligible to render the invention of general utility to the public. Several models, illustrative of the alleged invention, were produced, and a comparison made between them and models of the wheels of two of the defendant's vessels, the *Grand Turk* and the *Chieftain*, to show that the latter were made upon the principle of the plaintiff's specification. Witnesses were also produced to prove that workmen of competent skill could make the patent wheels from the information contained in the specification, and that the improvement in question was not known in the trade previously to the date of the plaintiff's patent.

The defendant's counsel relied mainly on the ground that the invention had been discovered and used long before the date of Mr. Galloway's patent by Mr. Field, of the firm of Maudsley and Field; and that gentleman, being called as a witness, stated that in 1833 he constructed a wheel on the improved principle now in question, which, upon application to the Lords of the Admiralty, he obtained a promise from them that he should have an opportunity of trying upon the first vessel that came to be prepared; that opportunity, however, was never afforded him, but he made an experiment upon a steam-boat, called the *Endeavour*, plying between London and Richmond, by substituting one of his improved wheels (of which a model was produced in court) for one of the *Endeavour*'s wheels. At the end of six weeks, however, the new wheel was removed and the old wheel replaced; because, according to the statement of the captain, the boiler was not large enough for the machinery to work it properly. In that same year he entered a *caveat* at the Patent-offices; and in 1835 he made a great number of experiments on the subject at his *manufactory*; but it *was not until the spring of 1836 that he fitted up a vessel called the Doren Castle* with wheels upon the improved principle, which were similar to the wheel tried upon the *Endeavour* in 1833.

The defendants, it was urged, had twice acknowledged the plaintiff's patent right, having on one occasion purchased their patent wheels for one of their vessels, and on another, in 1837, paid them 40*l*. for a license for Mr. Field to use their specification in constructing wheels for them—the latter, in 1838, having fitted up the *Great Western* with wheels on the patent principle.

The *Lord Chief Baron* summed up the case to the jury, and left three questions for their decision; namely, whether there had been any infringement of the plaintiff's patent by the defendants; whether the invention was new and unused at the date of the plaintiff's patent; and whether the specification was sufficient. With respect to the principal question, as to whether or not the invention was new, the mere fact of a series of experiments having been prosecuted previously to the attainment of the object to which they were directed could not prevent another inventor from availing himself of the experiments, and then adding the final link which was necessary to bring them to a successful issue. If, therefore, the jury thought that up to the month of August, 1835, the date of the plaintiff's patent, all that Mr. Field had done rested in experiments, those experiments afforded no ground for disturbing the plaintiff's patent, and in that case their verdict should be for the plaintiffs.

One of the jury wished to ascertain whether the wheel tried on the *Endeavour* was on the principle of the cycloidal curve; or, if the model of it were not in evidence, whether it might not be examined and compared with the original by some competent person.

This question gave rise to some discussion between counsel; ultimately

The learned *Baron* said that, as the person who had made the model was not present, he could not allow it to go before the jury.

The Jury then returned a verdict in favour of the plaintiffs, with nominal damages.

NOTICE OF A DIOPTRIC LIGHT ERECTED AT KIRKCALDY HARBOUR, WITH DESCRIPTION OF THE APPARATUS FOR CUTTING THE ANNULAR LENS TO THE TRUE OPTICAL FIGURE. BY EDWARD SANG, ESQ., F.R.S.E., CIVIL ENGINEER, EDINBURGH.

[Read before the Society for the Encouragement of the Useful Arts in Scotland.]

The harbour of Kircaldy, like the greater number of harbours on the coast of Scotland, is tidal, being left completely dry even at the ebb of neap tides. The larger class of vessels which frequent the port, can only

enter the harbour at or near the stream; and thus the increased commerce of the place had rendered it an object of some importance to have the entrance thoroughly lighted.

The harbour Commissioners having, in the summer of 1836, resolved to place a light at the east pier, my brother, Mr. John Sang, suggested to them the propriety of surrounding the intended gas-burner with an annular lens, so as to render useful the light that otherwise would have proceeded upwards. Having, however, felt some doubt as to the possibility of constructing a lens of this kind on so small a scale, he consulted me on the matter, and the ultimate result was, that I undertook to supply the lens.

My object in undertaking, at that time, such a task was two-fold. In the first place, I was desirous that no difficulty either in expense or in workmanship, should prevent such a benefit to the harbour; and in the second place, having been engaged in a long series of experiments on the art of cutting, and having arrived at what I conceive to be some general principles, I was willing to regard the formation of the lens as one of those experiments, or rather as a kind of test of the truth of the detected laws. The entire success of the attempt, has exhibited the possibility of turning or planing glass and of polishing it, to almost any required figure, and that with a degree of precision sufficient for many optical purposes.

The annular lens invented by M. Fresnel, and applied by him to the *Phares* of the French coasts, as also by Mr. Alan Stevenson; to some of our lighthouses, is a solid of revolution generated by turning the section of a common lens round a line passing through the focus, and perpendicular to the axis of the common lens. The focus is thus in the interior of the annular lens, and the rays proceeding from it, instead of being converged to a conjugate focus, are flashed out horizontally. On the large scale, these lenses are built of many zones, but, in the case in hand, only one piece of glass was used; and the nicety was this, to give to the surface of the small lens that variation of curvature, which is attained on the separate zones of the large lenses.

Three classes of difficulties presented themselves, first, the detection of the proper curve; second, the manufacture of the lump of glass; and third, the cutting and polishing it.

The first difficulty belongs to applicate geometry; and the detail of the method of resolving it, would be here somewhat out of place. It may be enough to notice, that the cylindric form having been determined on for the interior surface, on account of the facilities which it promised in the manipulation, the outline of the exterior surface necessarily became a curve of high order. The accompanying drawing shews the section of the lens full size; as it resulted from very laborious calculations.

The form of the lens being thus obtained, the next business was to procure the glass, and here obstacles presented themselves much greater than I anticipated. My first idea was to use flint-glass on account of its high refractive power, but after many attempts, of which the most successful result is presented to the Society, I abandoned that idea, and fell back upon crown-glass. The Messrs. Cookson of Newcastle, furnished me with two pieces, which reached me entire, but one, and unfortunately the better, had received a blow on one of its edges, and a tendency to split showed itself soon after commencing operations: it also accompanies the paper. The other was perfectly sound. On account of the lower refractive index of crown-glass, the lens was carried to less height than had it been of flint-glass.

My first business was to bore out the cylinder. For this purpose, I fixed a tin plate on the point of my drilling spindle, and having primed the edge of it wtth diamond powder, I cut out a series of grooves parallel to the axis: the ridges between these were removed by using intermediate stops on the lathe-spindle; and the whole was then smoothed out by a cylinder of lead with fine emery: it was then ground and polished in the usual way for hollow cylinders.

In order to cut the outside to the proper form, the lens thus bored out was chucked on a turned block of lead, which had been cast on an iron mandril; the surface of the lead being previously covered by a fine thread which was nowhere doubled. By this means the axis of the interior surface was made coincident with that of the lathe.

The evolvent of the required curve was then computed, and the edges of two plates of cast-iron carefully formed to it. These are seen attached to the cheeks of the accompanying frame, and are represented in the drawing. Two pieces of watch-spring were then made to bend over them, so that on uncoiling the springs, one point in each would trace over the curve wanted: these springs were then attached to the ends of an axis by adjusting pieces, and that axis had its parallelism preserved by means of a jointed frame.

This apparatus so prepared, was fixed on the bed of the turning-lathe, and the moveable axis rendered perpendicular to the axis of the lathe. On this moveable axis there were placed the cutters and polishers; it received motion by means of a small pulley fixed on it near one end.

To make the first approximation to the shape of the lens, an iron cylinder was fitted on the moveable axis, and its surface was primed with diamond. The lathe-spindle being still, this iron cylinder was brought over the glass, so as to cut part of a cylindroid surface, whose base was nearly the required curve; the lathe-spindle then being moved a division round, another surface was cut, and this was continued all round; as soon as a sufficient approximation was made both spindles were set to revolve at once, and the cutting continued till a uniform surface was produced. The iron tool with diamond was then replaced by a tin one with fine emery, and the separate motions were varied and reversed so as to produce every variety in the direction in which the surfaces met each other. Lastly, the tin tool was removed, and its place supplied by one of willow, the surface of which was covered with carefully worked putty; the same motions which had been used in smoothing were now employed in polishing, greater attention being paid to the frequent reversion of the motions.

It was on this combination of motions which I relied for producing a true finish. The nature of the action was this: suppose both motions to be dentral, the point of the polisher would meet the surface of the glass obliquely, the minute scratches inclining to the left, and the degree of inclination depending on the relation between the velocities. Let now the motion of the lathe be reversed, the direction of the scratches is immediately altered, and the one set of traces crosses the other. By varying the velocities, the direction of the scratches was still further changed, so that all those effects were, in this way, produced, which are obtained from crossing the strokes in the usual processes of grinding.

The lens, after being finished, was supported on three brass supports placed edgeways, so as to intercept little of the direct light, and between these was placed a small argand gas-burner with a sliding stalk, so as to be adjustable in height. The lantern within which the whole is placed is in the form of an octagonal decaedron, its top and bottom being squares placed 45° upon each other, and its sides isosceles trigons. The form was adopted because it contains the essential elements of strength, and because the side astragals being all inclined, would not, from any point of view, intercept a sensible portion of the light. The support of the lantern is a cast from the pattern of our police gas pillars; it is imbedded deep in the mason work of the pier.

The entire apparatus has a very insignificant appearance, and *may readily* be mistaken for a common street lamp. Notwithstanding its exposed situation during the past nine months, it has met with no accident (except the freezing of the water in the meter), and has afforded a sufficient light at a very trifling cost, and with scarcely any attendance; it is lighted in the evening and extinguished in the morning, and requires no attendance in the interval.

In designing this instrument it had to be kept in view, that the light was not to serve for distant vessels, but merely for those making the port. For this reason, only the upper half of the lens was used, and the lower edge of the bright flame brought into focus. A very copious light is thus thrown on the pier and on the water in the vicinity, so that the seamen can work the landing lines, and the custom-house officer make his entries with ease. The existence of the harbour light has, indeed, nearly doubled the number of opportunities for entering the port.

In order to complete the instrument, a reflective ring ought to have been placed on the top of the annular lens, so as to save some more of the rays that proceed upwards:—the funds placed at my disposal did not allow of that, but I have made provision, on the upper edge of the lens, for securing it there if it should be thought of.

To conclude, I may point out a mistake into which M. Fresnel has fallen with regard to the reflective rings employed by him. He places the focus of both the refracting and reflecting system at the lower part of the bright flame, whereas the focus of the refractors only ought to be at the bottom, the focus of the reflectors should be at the top of the flame.

EDWARD SANG.

Edinburgh, 13th April, 1838.

The Committee of the Society to whom this paper was referred, made the following Report thereupon:—

Mr. Sang's invention of grinding annular surfaces of any form by means of cutters attached to a moveable arm, whose end is guided by a spring uncoiling itself from the evolute of the curve surface which the lens requires, is novel and ingenious; and if equally applicable to the construction of instruments requiring great accuracy of form, promises to be extensively useful. The mode of giving any required direction to the scratches or small indentations made in the process of grinding, is very simple, and consists partly in reversing the motion of the cutter, or of the chuck on which the lens is placed, and partly in altering the ratio of the velocities of the surfaces in contact. Any degree of obliquity in the direction of these scratches may in this way be produced, both

from right to left and from left to right, and thus every possible variety in their direction must be the result; so that the whole effect ordinarily produced by crossing the motions in the usual grinding process, may be obtained. One would therefore, be induced to expect great accuracy from this method; and Mr. Sang has certainly succeeded in giving to the Kirkcaldy apparatus, a very fine polish, which is a matter of great importance.

We consider Mr. Sang's labours as important in regard to the manufacture of Light-house apparatus, and as calculated to improve the manufacture of refracting instruments generally; and we would, therefore, beg leave to recommend that his communication be made known to the public.

ROBERT STEVENSON.
ALEX. ADIE.
WILLIAM GALBRAITH, *Co*

Edinburgh, June 20, 1838.

MR. GEORGE RENNIE'S IMPROVEMENT IN PROPELLERS AND PADDLE-WHEELS.

On Friday last Sir John and Mr. George Rennie, accompanied by a few scientific friends went through a series of interesting experiments in the West India Docks, for the purpose of testing the capabilities of a new form of propeller. In this locomotive age, any invention tending to the improvement of our means and facilities of inter-communication, must necessarily claim a lively and general interest.

The present propeller in an important modification of the old paddle, being an ingenious application of a most simple and beautiful principle in nature, and one generally prevailing where the propulsion of the individual is her object, viz., that of the trapezoidal figure. Hence we may perceive that the tails of fish, the feet of aquatic fowls, and the wings of birds, generally partake more or less of this character; for as was justly observed by the talented inventor (Mr. Rennie), nature never attains her ends but by the best and most efficacious means. The mode by which the propelling power is conveyed to the vessel is not dissimilar to the old wheel, the improvement being principally in the arrangement and form of the floats, which are not very unlike the canoe paddles used by many of the South Sea Islanders. By the way it is worthy of note, as a singular and remarkable feature in the genius of savage life generally, that felicitous adaptation to its own uses of the wise economy with which nature invariably operates her purposes.

The more obvious advantages derived from the present invention, consists in a reduction of more than one half in the breadth of the paddle-wheel and boxes; consequently, the same amount in the superficial area of the floats, with at the same time an increase of effective power, which, differently from the common method, act with their length vertically, thereby giving so much additional compactness to the whole; a vast improvement it must be admitted in the efficiency of vessels subject to the roll and action of a heavy sea. The other and more practical advantages are in the smoothness of the motion, creating little or no agitation in the wake of the vessel, a desideratum in river or other confined navigation; the facility of suiting the immersion to the variable draught of the vessel, above all, the perfect equalization of the power to the effect in every portion of the float. We understand that the plan theoretically has met with the approbation of Professor Barlow, and other scientific men. The experiment was tried upon a beautiful little vessel, and in a succession of trips made during the course of the afternoon, up and down the spacious area of the import dock, it was particularly remarked the ease with which she turned and threaded her way among the numerous craft lying in the basin. The gentlemen present, among whom was Captain Austin, R.N., expressed themselves in the highest terms upon the satisfactory result of the experiment, being from the peculiar simplicity of the construction admirably adapted for war and sea-going steamers. The patentees we believe intend shortly applying the principle upon a more extended scale.—(*From a Correspondent.*)

ON THE APPLICATION OF WATER TO ANTHRACITE FIRES.

[*From the Mining Journal.*]

All persons who have been much accustomed to the use of anthracite for fuel, seem to entertain an idea that the application of water has a beneficial effect. It is the invariable custom of the old inhabitants of the districts where no other fuel is used, to wet the coal before putting it on the fire. A wet paste of small culm, mixed with clay, makes a more lively and pleasant fire than stone coal alone. This must arise from the clay retaining a portion of the water until decomposed by the ignited carbon of the coal producing the gases. carbonic, oxide, and carburetted hydrogen. It has been suggested, that the application of the vapour of water to anthracite fires in steam-boilers would supply the gaseous or volatile properties of bituminous coal; there is, however, much difficulty in the perfect development of the principle, arising from the

compact structure of the coal, and the close manner in which the pieces of coal seem to adjust themselves in the fire. It is necessary that the coal be kept in an active state of combustion while the vapour is passing through, but so little passage being allowed through the fire, when the vapour of water is applied, it shuts off the supply of air, consequently the combustion is diminished. It requires both a very high temperature and a large quantity of pure air, with a full *quantum* of oxygen, to consume carburetted hydrogen—the most important of the two gases. Carbonic oxide burns at a very low temperature, and produces little heat. A quantityof flame may easily be produced by steam passing through an anthracite fire, but it is chiefly that of the latter gas, the former being volatilised without burning, and its powerful effect, consequently, lost. Besides the air necessary to keep up the combustion of the coal in the fire, a large quantity is necessary to consume the gases, and that, too, at a high temperature. It appears impossible to attain these results with a common draught.

The writer, after considerable experience, is decidedly of opinion that anthracite cannot be used with advantage in ordinary boilers without a blast. When a blast is used, although it may be difficult, yet it is not impossible, to devise a method of producing the full effect from the application of water to an anthracite fire; it is a subject of vast importance, and well worthy the attention of young mechanics and engineers—a fine field for the exercise of their ingenuity. It is quite certain that some anthracite contains 95 per cent. of pure carbon, and were it possible to render the entire effect of this available, certain portions of it converted into volatile inflammable matter by its union with the elements of water, and steadily and continuously applied to the tube or flues of a boiler without loss, anthracite might be considered as a species of concentrated fuel —an invention of incalculable value for steamers going upon long voyages. When anthracite is used for blacksmith work, there is abundance of heat, but a large quantity of cinder is formed; this cinder has generally been considered as a mere oxide of iron, but it certainly contains carbon. It is the same cinder which is produced in large quantities in the refining process of the iron works. Possibly oxygen and carbon, in the proportions to form carbonic oxide, are combined with the iron. A minute quantity of water running into a blacksmith's fire, when using anthracite, would remedy this—the presence of hydrogen preventing, *in a great measure, the formation of the cinder. It is an axiom in the north of* England, that a good gas coal is a good smith's coal, and *vice versâ*. It will be quite impossible to manufacture malleable or bar iron of good quality, using anthracite for fuel, without the application of the vapour of water. This is a subject of the deepest interest to parties embarking in iron works, where anthracite must be used for fuel. A patent for producing gas, by passing steam through a retort charged with anthracite, has been taken out by E. O. Manby, Esq., C.E., of Swansea—a gentleman possessing a thorough local knowledge of the anthracite district of South Wales, and who has had the best opportunities of judging of the powers and capabilities of the coal. He produces gas of great illuminating power rapidly and abundantly, which requires no purification. It seems likely that the distinguishing feature in the difference of the several varieties of coal depends upon the presence of the elements of water, either entire or in varying proportions, that are combined with the carbon—anthracite being quite free from them. It is a fair speculation to imagine that the anthracite veins of coal at some period possessed bituminous propertias, but that being more immediately acted upon by volcanic commotion, all volatile matter was expelled, while extraordinary pressure being applied, left the coal a solid compressed mass of carbon, constituting the peculiar characteristic of anthracite.

MANBY'S PATENT MODE OF MAKING GAS FROM ANTHRACITE.

[Patent dated May 8, Specification Inrolled, Nov. 8.]

We take the opportunity of adding some additional information upon the subject of Mr. Manby's invention, referred to in the preceding article. The following notice of his specification we extract from the *Inventor's Advocate*, a newspaper recently commenced, which would have a greater chance of success, were its matter more exclusively devoted to the subjects of its first title:—

" Edward Oliver Manby, civil engineer, Swansea, Glamorgan, new method of manufacturing gas for the general purposes of illumination. By this invention steam is introduced into the retort containing anthracite or stone-coal, culm, charcoal, &c.

" The retort or closed vessel, about eight inches diameter, is placed vertically, and projects in front with an opening, for the purpose of taking away the coke from the lower end; the upper end where the coal, &c., is introduced, curves the contrary direction to receive the funnel or hopper; im-

mediately over the retort is a box or receptacle, with a flange above, held down by a tripod; at the bottom of this box is an emission pipe, reaching down the centre of the retort; the furnace is placed round the retort, which is brought to red heat, when the small coal, added to one part slacked lime and nine silicious sand, with one clay to prevent caking, is put into the retort red heat, and the lid is fastened or held down by a tripod; the steam is now introduced from the boiler through a pipe at the lower end of the retort, and the generated gas passes into the emission pipe through the perforated fine holes, when it is carried into the box or receptacle to the hydraulic cylinder, and then to the gasometer.

"The steam-pipe is conducted behind the furnace, the heat of which increases the power of the steam; to this pipe is a cock or valve, to shut off the steam when not required; for should the carbonaceous matter produce but small quantities of hydrogen gas, the steam must not be so freely admitted; and, otherwise, should bituminous coal be used which generates tar, the application of steam is increased, also the heat round the retort; thus, by the co-operation of steam and heat, a large portion of gas is taken from the tar."

D'HARCOURT'S PATENT ARTIFICIAL GRANITE AND MARBLE.

[Patent dated March 6; Specification inrolled September 6.]

Mr. D'Harcourt describes his method of making his artificial granite and marble as follows:—

"I first cast a quantity of resin into a melting-pot, and when the resin is perfectly melted, I add linseed oil or tallow thereto, in proportion to the degree of ductility I wish to give to the mixture. The quantity of oil which may be added, is from one pint to one gallon to a ton of resin, and the quantity of tallow from about one pound to eight pounds to a ton of resin. The purpose of adding the linseed oil or tallow being to give the resin such a degree of ductility as will enable it to mix with the other ingredients herein subsequently directed to be added, the exact proportions to be used will depend greatly on circumstances, and must be left to the experience and judgment of the operator. I next add to this liquidized resin about twice its weight of whiting or chalk, well pulverised, and stir or agitate the whole till the resin, oil or tallow, and the whiting or chalk are thoroughly mixed and incorporated with one another, taking particular care to distribute the whiting or chalk as equally as possible throughout the whole mass, and that none of it is left in the state of lumps or patches. I now leave this composition or mastic to stand for about one hour, and then withdraw it from the melting pot in the form of loaves, by means of wooden or other moulds. These loaves are now ready for going through the following additional processes, in order to convert them into artificial granite or stone. I put one or more of these loaves again into the melting-pot, and when they are perfectly melted I add well-picked oakum or other suitable fibrous substance, in the proportion of about ten pounds to a ton of the other material, stirring all the while the ingredients of the pot with a spatula or other agitator. When the oakum or other fibrous material has been well incorporated with, and diffused throughout, the mastic, I add from six to eight times the weight of the mastic of perfectly dry sand, stirring again till the sand is thoroughly mixed with the other materials. The whole of this composition or mixture is then left to boil for about two hours, after which it is in a state fit to be applied as a substitute for natural granite or stone, in manner following:—

"*For Pavements.*—The ground having been duly prepared, a first layer of the composition is spread thereon (being taken from the melting-pot in a fluid or semi-fluid state) to the thickness of about one-fourth of that intended to be given to the whole block or stone. Another layer is afterwards added of three-fourths the thickness of the first, and its surface smoothed by means of hot irons.

"Railway-blocks, columns, pillars, urns, slabs, blocks for building, or other articles usually cut or hewn out of natural stone or granite, may be made of this composition by casting it in moulds of the desired shape.

"*To make Artificial Marble.*—I take the mastic or composition made as first hereinbefore directed, and melt it in a clean melting pot, taking great care in the course of melting that no particles of soot, coal, wood, or other foreign matter get into the composition, which might make the polishing of the artificial marble into which it is to be formed, difficult, if not impossible. When the mastic or composition is perfectly fluid, I add thereto thrice its weight of pulverised whiting, and stir the whole well together, after which the pot is to be left to boil for about two hours. I then add natural marble of different colours, broken into small pieces, in the proportion of two parts for each part of the resinous and chalky composition. The pieces into which the natural marble is broken must not be so large as that any of them shall get detached in the course of polishing the artificial marble, as herein-

after directed, so as to leave holes and flaws in the surface thereof. Instead of the broken marble, small pebbles, or large pebbles, or flint broken into small pieces, may be used; in which case the flint or pebbles must be perfectly clean and dry, with no particles of earth, or dirt, or sand adhering to them. This mixture must be left to boil for about an hour, and must be stirred the while, so as thoroughly to intermix and incorporate the ingredients with one another. The mode of applying this composition so as to produce an artificial marble, suitable for tesselated or other pavements, is as follows:—the ground or floor upon which it is intended to lay the pavement being duly prepared, the whole surface is to be covered with a first layer or foundation of the artificial marble composition, of about one-fourth of the entire thickness of the intended pavement. The design or pattern desired to be given to the pavement is formed in zinc or tin moulds or frames of three-fourths the depth of the first layer or foundation, and these moulds or frames being placed upon the first layer or foundation, the fluid composition prepared as aforesaid, is to be poured into them. As soon as the contents of one set of patterns or designs is hard and dry, the metal frames or moulds are to be removed, and a further portion of the pattern proceeded with, and so on to the outer border or edge of the piece of pavement or parquetry to be formed. The surface of a pavement so formed, being perfectly dry and hard, may be ground and polished in the same way that natural marbles are polished. When the surface is made perfectly smooth, and to the eye perfectly homogeneous, a varnish of gum-lac may be passed over it. The artificial marble, whether employed for pavement or other purposes, will be, to a certain degree, of the colours of the materials of which it is composed; but in every case the appearance will be more or less that of natural marble."

THE "CYCLOPS" ENGINES.

The engines of the *Cyclops* steam-frigate, of 320 horse-power, built by Messrs. Seaward and Capel, were set to work for the first time on Wednesday last. They are beautifully constructed, upon the same plan which has been so successful in Her Majesty's ship *Gorgon*, and in the Russian vessel, the *Nicolai*, in which the crank shaft is connected to the head of the piston rod by a short arm. All the supposed objections to this plan have been removed by the nicest calculation, and ingenious design in connecting the several parts. The engine was fitted with Mr. John Seaward's heat savers and expansion gear; and with Mr. Samuel Seaward's salt gauge, described in our last vol., p. 353. The ship was moored in the City Canal; she is fitted with the cycloidal paddles. Everything was in complete order, and worked well. The salt gauge could not then, of course, be put to the test. Two beautifully made models were shown on board, one made to scale from the engines of the *Cyclops*, and another of the common marine engine, made to the same scale for the same power. These strikingly exhibited the advantage, in points of simplicity of parts, weight, and space, which Messrs. Seaward's engines possessed.

THE PRESIDENT.

Whilst in the neighbourhood we paid a visit to the *President*, in the yard of Messrs. Curling and Young. The din of busy preparation for the launch, which takes place this day, was going on. The stupendous size of this ship is seen with striking effect in its present state, while void of its internal fittings and engines. Her length is 265 feet; breadth, 64 feet; depth, 23½ feet. Her engines, of 540 horse-power are making by Messrs. Napier, of Glasgow. We hope that no such untoward events as occurred to delay the completion of the *British Queen* will take place, to prevent the *President* commencing her traffic across the Atlantic.

HUNT'S PATENT PROPELLER AND STEERER.

A very ingenious plan, in which the actions of propelling and steering a vessel have been combined in one piece of mechanism, has lately been invented by Mr. Hunt, an engineer connected with Mr. Penn's works at Greenwich. It has been tried on a small scale, and found well calculated to suit river and canal navigation. For the passenger traffic which has lately been established on the Thames between Westminster and London bridges, it is most admirably adapted. The present steamers, well constructed and managed as they are, consume more time in calling at the various landing places on the route, than they do in running the actual distance. This is in consequence of their having, when the tide is in their favour, to sweep round and come in against the current; they have also to manœuvre the boat so as to get the tide to help to turn them round. With Mr. Hunt's apparatus none of this would be necessary. As far as we can judge

from the scale of boat we have seen at work, he can run in at any point, either with or against tide, stem or stern foremost; or even make the boat turn round—*pirouette*, in fact, upon its centre. As no swell is produced the plan is likewise well adapted for canal navigation. Apparatus is in the course of construction for a vessel of considerable size, which will be ready early in the spring; and if its operation shall proportionally equal that of the first experiments we have witnessed, the invention will be a most important one.

NOTES AND NOTICES.

Registration of Designs.—Since the announcement, by the Lords of the Treasury, that the four-penny postage per half ounce was to come into operation on the 5th instant, a great many designs for letter weights have been registered under the recent act to protect the copyright of designs of articles of manufacture in metal, whereby a kind of patent is secured for three years at an expense averaging about five pounds. Amongst the number are some very neat and convenient plans by Mr. Riddle, the ever-pointed pencil-maker, of Blackfriars-road.

The Fourpenny Postage.—A single number of the *Mechanics' Magazine*, printed on *thin paper*, will come within the weight of a single letter under the new Post-office regulations, and even admit of a light envelope. Patentees and inventors have thus an opportunity presented them of cheaply circulating a knowledge of their improvements amongst their friends, or a particular class to whom they may be interesting, and writing a letter at the same time.

The Oil in the Wool of Sheep.—A series of experiments have been made in France, to ascertain the real value of the oil in the wool of sheep, both as manure, and as a material available in the arts; from which it appears that this oil or grease, which is now wholly lost, has a marketable value for the arts of 5s. per 100 lb. There is also reason to presume that 3000 lb., if dry, would be sufficient to manure 2¼ acres of land, with a saving of nine-tenths in the expense of carriage. It might either be sprinkled over a plant like water, or placed round its roots, consequently it would be most useful in the cultivation of vegetables for large markets. It makes an excellent compost, either with seven-eighths of marl, clay, peat-ashes, lime, or sand; and in this case admits of being spread by the hand. It is evident that agriculture would derive very great advantages from a manure so rich and serviceable in the cultivation of potatoes and vegetables of every kind, and at the same time so well adapted for improving grass lands, and for increasing those valuable crops which require so many weedings—such as flax, hemp, tobacco, beet-root, and all oleaginous plants.—What an important service would be rendered to agriculture if this manure could be made available, which is now lost, but which would average yearly 134,000 tons.

Bone Dust for the Cultivation of Grain.—The expo tation of bones from Germany to England constitutes a singular epoch in the annals of commerce. Myriads of tons have been already exported without glutting the market, or causing a cessation of the demand. In the North Sea, mills have been erected to pulverise them. This boue powder, or dust, was long ago exclusively applied to the purposes of hot-houses by German horticultnrists; but, the English, emboldened by their riches, have extended its use to general objects of agriculture, and fertilise, by these expensive means, their cold, humid, and poorest land; and have thus brought the uplands of Nottinghamshire, the western parts of Holderness, &c., into the highest state of cultivation, both in point of extent and intenseness of fertility. There is, consequently, a proverb, "that one ton of German bone dust saves the importation of ten tons of German corn." As Malta formerly covered her naked rocks with foreign soil, so does England now fertilise her clay and sandy heaths with German bones. Near the sea coast, even the church-yards are robbed of their venerable relics, which is only ironically excused by rendering the German bone trade popular. An agriculturist, being rendered attentive by this vast exportation, instituted privately some comparative experiments, the result of which proves that bone dust acts in the cultivation of ground, as compared with the best stable manure—1. In respect to the quality of corn as seven to five. 2. In respect to the quantity as five to four. 3. In respect to the durability of the energy of the soils as three to two. It produces several collateral advantages—1. It destroys weeds. 2. It diminishes the necessity of suffering the land to lie fallow. 3. This concentrated manure, or substitute for manure, is more easy of conveyance, less laborious to spread, and can with facility be applied to the steepest vineyards or other inaccessible lands, either in mountainous countries or in wet meadow land. 4. It renders agriculture practicable without cattle breeding, grazing, &c.—*Repertory of Inventions.*

Improvements in Woolwich Dock-yard.—It has been found expedient to construct an immense new dry dock for steam and other vessels of war in this Government yard, the Admiralty having resolved upon filling up the former intended new dry dock, which, from strong springs, it was found impossible to make available, after an expenditure of upwards of 70,000*l.* Cofferdams have been formed on the southern side of the magnificent basin, and an excavation commenced, which is proceeding very favourably under the superintendence of an officer of the Royal Sappers and Miners (Lieut. Dennison), who is attached to the dockyard for the purpose of inspecting the new works. The site of the new dry dock has already been excavated 20 feet, and as yet there has not been any spring met with to arrest the progress of the undertaking, which, when completed, will render the basin and docks of Woolwich yard among the most commodious in the country.—*Times.*

The Menai Bridge is undergoing a complete repair, having suffered considerable damage in the storm last winter. Government has granted 8,000*l.* but this is by no means sufficient.

Madder.—*The Alsace* states that a method of printing stuffs with madder has been found out at Vienna. A reward of 30,000f. for this discovery had been offered in France.

Dry Feet.—Messrs. Herapath and Cox have forwarded to our office a few hides of their patent tanned sole leather, to afford an opportunity to the London boot-makers and boot-wearers of trying the merits of their article. They have requested us to allow any one to purchase one or more hides; and as both we and some of our friends can bear testimony to the good qualities of the leather, we are happy to comply with their desire.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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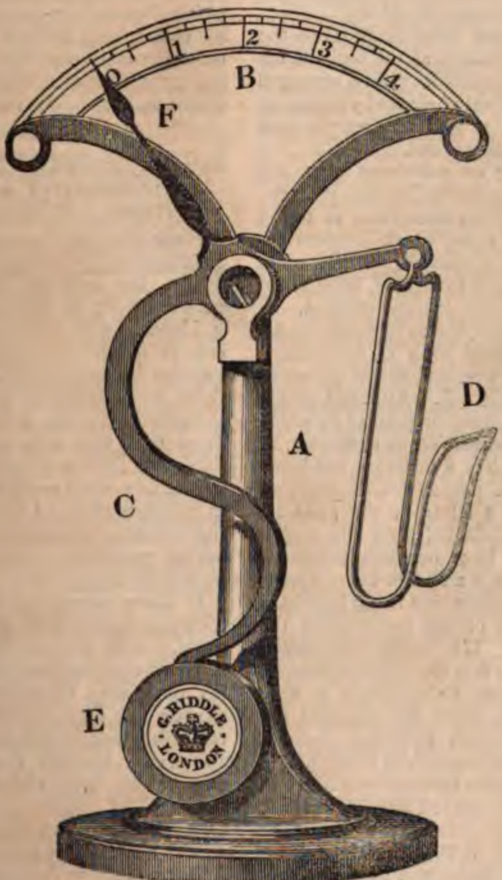
RIDDLE'S REGISTERED SELF-ADJUSTING LETTER-BALANCE.



RIDDLE'S REGISTERED SELF-ADJUSTING LETTER-BALANCE.

In our last number (page 176) we noticed the circumstance of several letter-weights having been registered under the Designs Copyright Act, (2, Vic. c. 17,) and among the number, some very neat and convenient plans by Mr. Riddle, who has registered three distinct machines: all of them self-adjusting, and of considerable merit. We have this week the pleasure of laying before our readers a description of the first of this series (No. 113, Nov. 28, 1839.)

Mr. Riddle has felicitously taken the old *bent lever balance* as the basis of his two first plans, which he has so arranged as to be exceedingly neat and pleasing in its appearance, as well as accurate and distinct in its indications.

The drawing on our front page will render all this apparent to our readers; an upright shaft A, terminates at top in two divergent arms, which support between them a graduated arc B, upon which the weights in ounces, subdivided into quarters, are legibly marked. A serpentine lever C, has at one end a scale-pan, or suspending hook D, for holding the letter to be weighed, and at the other end a heavy weight E. Attached to this lever there is a hand or pointer F, which moves with it, traversing along the arc B. The weight E has a constant tendency to remain in a perpendicular position, but on placing a letter in the scale D, the weight is deflected, and the length of the effective lever becomes increased until the weight is an exact counterpoise for the letter, its amount being indicated by the position of the index upon the graduated arc. Mr. Riddle has limited the range of his first size to three ounces, by which means he produces a very compact article, while the divisions are exceedingly distinct and well defined. Our engraving is two-thirds of the actual size. It is evident that not one letter in a thousand will exceed the half-ounce, nor one in fifty thousand weigh more than an ounce, so that for general use the three ounce range will be amply sufficient; by adopting a larger size, the same principle will hold good for sixteen ounces or even more. Being divided to quarters of an ounce, Mr. Riddle's letter-balance is suitable for foreign as well as *English post-letters,* an advantage not afforded by any other contrivance that we have seen for letter weighing. The vibrations of this balance, have by some persons been thought objectionable, but it is evident that these will always be in exact proportion to the delicacy of the instrument. In Mr. Riddle's last registered plan, (No. 124) the utmost accuracy is obtained without any vibration whatever; and where accuracy and expedition are required to be combined, this plan seems calculated to be eminently useful.

Mr. Riddle's pocket-balance attached to his Patent Ever-pointed Pencil, capable of weighing half an ounce, and one ounce, and therefore effectually determining three rates of postage, is also a highly useful and ingenious contrivance.

REMARKS ON THE SUPPOSED IDENTITY OF ELECTRICITY AND CHEMICAL AFFINITY. BY HORATIO PRATER.

Since the late researches of Professor Faraday on the origin of voltaic electricity, the opinion, broached, first I believe by Sir H. Davy, that this power is identical with electricity, seems every day to be gaining ground. Professor Faraday himself conceives that his laborious and admirable investigations lead to this conclusion. I do not presume to deny that this *may* be the case; but think that further experiments are wanting before such an opinion can be said to be *established.* I beg leave to direct the attention of philosophers to the following particulars, which I put for the most part as queries:—

1. There seems no doubt that electricity is produced by the oxidation of a *metal.* But has electricity yet been shown to be produced by the oxidation (so to speak) of other bodies? Yet oxygen has often a powerful affinity for other forms of matter than the metallic; and even in the pile the electricity may only be the effect and not the cause of the affinity? Indeed, as far as we can ascertain priority in this case, electricity would appear only a sequence or result. Affinity seems to exist in the copper and nitric acid as an ultimate property of matter. You cannot bring them together, but they unite immediately. When *they have* united, indeed, we can immediately discover that electricity is produced. But examine them separately *before* combination, and what electricity

hey manifest? Has it been shown they have inherent and *opposite* tricities, and of the *highest energies ible?* For *both* of these conditions n necessary to account for their *very ng* affinities for each other.

Professor Faraday states, that when *d* chlorine is used instead of the s, that no electricity is produced, gh the chemical action is powerful.* not the affinities, then, in this case pendent of electricity? What power es the chlorine unite with the metal? Oxidation produced under *particu- ircumstances*, as Professor Faraday , seems the cause of the electricity of pile. But very strong affinities are n manifested when no oxidation tever seems to take place. Thus, sulphuric acid into a solution of barytic salts, and a precipitate of the hate appears immediately. Has elec- ty been shown to be produced in this ?—Electricity of a *powerful charac-* for such alone can be efficient in lucing such strong affinities. Many he *gases* likewise show very strong ities for each other. Can this de- d on electricity?

I do not know whether it be not in favour of chemical affinity and tricity being distinct properties of ter, that no *strong combinations* seem ned by the pile. To be sure, one al may be precipitated on another by n agency, and an affinity be produced could not take place otherwise. But combination is, comparatively speak- very weak. The metal deposited generally be easily rubbed off, and h more easily still if the matter be earth. These phenomena certainly w that electricity *may* influence che- al affinity; and this was to be ex- ted, since it seems a power so univer- y diffused. But is it not possible to nit that electricity may somewhat *in- se* or *diminish* affinities, without be- the essential *cause* of them? May it be possible also that electricity should able to increase, or actually to give affinities to *metals*, and to no other form of matter? Electricity may surely be a force capable of overcoming the most powerful affinities of matter (that of pot-assium for oxygen for instance) without actually being affinity itself?

When attentively considered, even the case in which affinity seems actually to be *given* by electricity, as in the precipi-tation of copper on silver, &c., when this, in contact with iron, is put in a so-lution of sulphate of copper—one of the cases above alluded to—does not seem to favour the idea of the identity of elec-tricity with affinity. The metal seems to be merely reduced by the hydrogen determined to the silver, and *deposited* on the first substance with which, in such reduced state, it comes in contact. It is not, strictly speaking, *chemically* combined with the silver.

When acids are used which only act on one of the metals in a state of separa-tion from each other, on conjoining them we find that the affinity of the acid for the *soluble* metal is only *increased*, and no affinity *given* to the *insoluble* metal. Hydrogen, indeed, appears on it; but does not *unite* to it, and none of it is found to be dissolved by the acid. At least as far as our experiments have gone this has been the case, and we believe it is generally admitted as a fact. Again, if the fluid acts on *both* metals, on con-necting them, the action is altogether transferred to the most oxidable; and this case is similar, or very *nearly* so, to the one just mentioned, since the che-mical action is in such combinations very unequal before the metals are joined. On the whole, it would appear that affinity may be *increased* or *dimi-nished* by electricity, but not *given;* and this not only shows that affinity is a dif-ferent power from electricity, but also from that (as we may observe in passing) engaged in regulating the chemical ope-rations in animal and vegetable struc-tures. Organic compounds are formed not only independent of metallic action, but are, in the strict sense of the word, *given;* since they are annihilated as soon as, or very shortly after, vitality is ex-tinct. In the vegetable world, however, as the combinations remain much longer after life has departed than in the animal, the affinities in this latter case would ap-pear to be more decidedly different from

* Electricity, however, is probably in general pro- d during *all* vivid chemical action. Thus it s to be in Bacquerel's apparatus, by the action ric acid on potass or alumine. But, supposing the case, the reasoning *in the text seems still, whole, equally conclusive.*

common chemical affinity, than in the former.*

It would be wrong to close these remarks without alluding to some cases where a slight chemical affinity *appears* to be actually given by galvanism. We say appears, for we think it even doubtful, in such cases, whether such slight affinity is correctly said to be given even in these cases. Let us take the following experiment as an example.

Gold in contact with zinc was left in common water a week. The surface of the zinc was found to be slightly oxidized, and a small portion of lime precipitated on the gold. As this precipitate, or deposit, rubbed off immediately, it could not be said to be a case in which chemical *affinity* was given. It was not in *union* with the gold, and taking the term in its general sense, chemical affinity supposes a combination in which the properties of the separate substances are more or less decidedly destroyed.

There is more difficulty with respect to the oxidation of the zinc; since when some of the same portion of metal was left in the same water *without* the contact of gold, it preserved its brilliancy unimpaired during the week. But what was the cause of the oxidation when the zinc was in contact with gold? Under such circumstances an electric current was produced in consequence solely of the *contact* of the metals. This current decomposed the sulphate of lime, &c., existing in the water, and determined the sulphuric acid to the zinc, which, *by the laws of ordinary affinity*, was of course, under such circumstances, oxidized. I do not know whether this explanation, which makes electricity indirectly, and *only indirectly*, the *cause* of oxidation, *where a fluid is unable to oxidize the metals in a state of separation*, and when one becomes oxidized, when they are joined, be correct. But supposing that it is not, then we should say that the electricity merely hastens, and does not cause the affinity. Zinc alone, if left *long enough* in water, would, we may suppose, become oxidized. In this view then, electricity, not as being electricity, but, as under the circumstances in which it is evolved, determining acid in the solution to the zinc, only *hastens* common chemical affinity; and on the first view only *indirectly* causes it. View the matter which way we will, electricity and chemical affinity appear totally *distinct* powers. The former merely *influences* the latter.

But suppose even the affinity actually caused by a *direct* power of electricity in this case, such affinity is a mere nothing compared with ordinary chemical affinity. Zinc and gold is the *strongest* galvanic combination, yet the water, so far from acting briskly on the zinc, dissolves no perceptible quantity of it in a week!

The more this subject is considered, the more in our opinion will it become evident that electricity merely modifies ordinary chemical affinity, and, consequently, should be classed among such agents so admirably pointed out, and commented on by Berthollet. Indeed, some of the agents mentioned by this philosopher, as heat for instance, seem to have frequently a far greater power of *increasing*, if not of actually causing, affinity, than has electricity.

P.S. Since the above remarks were written, I find the Baron Thenard, in the last edition of his "System of Chemistry," advocates the same doctrine that is embraced in this article. As, however, the reader may probably consider that some additional arguments are advanced in the present paper, I have thought it right not to lay it aside. Of course, where our arguments are alike the Baron has the priority.

* This argument, however, is only insisted on to a certain extent. The power of vegetable life in controlling affinities is, perhaps, as great as that of animal life in effecting the same. Plants begin the work which animals finish. Plants, probably, organise water and air; or render these elements, as they were formerly called, solid. Animals do not so decidedly do this. They merely act on and assimilate matter *already* organised. They rather tend to *preserve*, than *give*, *vital* affinities. The reason why wood is a more permanent compound than that of animal bodies, is probably not so much because it is formed by a power that more nearly resembles ordinary chemical affinity, than that which forms the structure of animals; but rather because the composition of wood is such as to resist the play of ordinary affinity better (air and water) than dead animal matter is. When the affinity of a me*tal for oxygen is caused* by heat the metal remains *oxidised, although cold.*

REMARKS ON THE NATURE OF CHEMICAL AFFINITY IN REFERENCE TO BERTHOLLET'S OPINIONS. BY MR. HORATIO PRATER.

Berthollet, as is well known, admitted the existence of such a power as che-

l affinity; he only conceived it was *elective*. Although this opinion is to have been satisfactorily refuted 'rofessor Pfaff,* it is proposed in the ent place to make a few further re- ks on the subject; and first we will e Pfaff's strongest objections, and hollet's reply; for adjoined to the r in question, are notes and com- ts by Berthollet himself.

ou may remove, says Pfaff, the whole ne barytes from muriate of barytes, ropping in enough sulphuric acid. , the force of cohesion to which hollet attributes this effect, does not ill, or exist "till, the combination is e." This is certainly true: the sul- ic acid must *unite with*, and, conse- ntly, show an elective affinity for, tes, *before* a precipitate falls. Ber- et makes no satisfactory reply to this ction.

lly. You cannot decompose the sul- e or muriate of an alkali by pure mag- a, says Pfaff; boil as long as you no free alkali is obtained. And here may observe that heat (itself often rently a powerful agent in producing ity), is shown to have no effect, gh assisted by an indefinite *quan-* Berthollet only replies by consi- ng this an exception to his general

Sulphuric acid instantly causes a ipitate in solution of muriate of lead; says Berthollet, by *boiling* muriatic on sulphate of lead, you obtain tals of muriate of lead. Now, it will observed in this case, that heat is l, often *itself* (as we just observed) cient to cause combination or affi-

"I have sufficiently multiplied fs," says Berthollet, "that it is the nce of chemical action to increase in portion to quantity."—(Statique Che- ue, I. 339). It may be replied to , that we may admit quantity to have n great effect, and yet hold that *elec-* affinities may exist. Considering ity as an essential property of mat- it will, as a consequence, be inherent every individual atom, and, conse- ntly, must be more or less influenced nass.

he great merit of Berthollet's writ- on this subject, consists in his hav- so well shown that elasticity, cohesion, &c. &c., *influence* chemical affinity; and, consequently, that such affinity is not so powerful as Bergman and former chemists considered it to be. In an essay which we propose to write on what has been called *vital* affinity, we shall probably turn this consideration to some account. Certainly to Berthollet science is deeply indebted; but his philosophical mind led him in this case to simplify *too* much.

Cohesion is a species of affinity; and often much stronger than chemical *elective* affinity. Whether cohesion be in its nature similar to the attraction of gravitation, might afford an interesting subject for inquiry. Elective affinity is perhaps, properly considered, only a *modification* of the power of cohesion. Instead of combining between *themselves*, the particles of matter in this case tend to combine with some of opposite, or different characters. Cohesion and elective affinity seem, however, to be *two essential properties* of matter, perfectly distinct, though, in the respect just mentioned, bearing some resemblance.

* nnales de Chymie, tom 77.

DE BREZA'S PATENT FIRE-PROOFING COMPOSITION.

A patent was last year granted to a gentleman of the name of De Breza, for his invention of a new composition for rendering cotton or woollen cloths, paper, wood, and other articles, uninflammable. We now publish an account of his process, abridged from the specification of his patent.

For Fireproofing undressed and unbleached goods.—In two pints and a half of water, heated to 190 degrees of Fahrenheit, throw one ounce of alum, one ounce and a half of sulphate of ammonia, half an ounce of boracic acid, one drachm of animal glue, the clearest you can get, and at last one drachm of starch diluted in a small quantity of water. Care must be taken that every one of those products is dissolved separately in the above described order, and not one before the other; and previously to putting in the starch, the heat is to be raised to at least 212 degrees Fahrenheit. The goods are then dipped slowly into the solution, and, when well saturated, they are pressed or wrung to eject any redundance, and are then dried at the temperature most suitable.

For printed and dyed goods, the solution is prepared as above stated; the temperature of it is, however, only 140 degrees. The goods are to be spread on a table, and a sponge, dipped into the solution, passed over them, taking care not to put on too much of the solution for fear of taking away the colour. If the goods are fast colours, dip them in the way already described. Finish the operation as in the first process.

For cannon cartridges very close calico may be used for making these articles; to the mixture already described, add half an ounce more of alum, and half anm ounce more of boracic acid, and employ half an ounce less of sulphate of ammonia. When the calico has been prepared with this mixture, and dried, cover it with a light coat of carbonate of lime and of animal glue, a composition similar to that used for whitewashing.

For paper and pasteboard the compound is the same as already stated, except that double the quantity of alum and of boracic acid is used, and only one-half that of the sulphate of ammonia, which in every case must be well purified from all excess of acid. If the paper or pasteboard are already manufactured dip them in the compound, and end the process as mentioned for the other articles. But if the paper or pasteboard are still in an incomplete or pulpy state, mix the compound with the pulp prepared for the making of paper or pasteboard, and their fabrication is finished in the usual way.

For the canvas of theatre sceneries the compound is as follows:—Two pints and a half of water, two ounces of alum, two ounces of sulphate of ammonia, one ounce of boracic acid, half an ounce of glue, and four drachms of starch, which are prepared and apply as stated before; but if the sceneries are already painted and in use, paste on their inside, or wrong side, some of the paper prepared as described.

Every kind of wood and timber may be rendered fireproof by immersing them in the solution. The wood or timber must at least remain 24 hours in the solution and be entirely covered by it; and it is to be borne in mind, that the time which they are to remain immersed depends on the bulk and on the quality of *the wood; the hard* dense woods requiring more immersion than the more tender and porous ones, and in every case the temperature of the solution must be always at about 168 degrees of Fahrenheit.

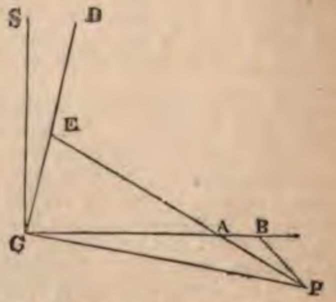
As this composition contains boracic acid and sulphate of ammonia, it has the additional advantageous property of preserving entirely, in all climates, every article saturated with it, from the ravages of worms and of insects.

ASTRONOMICAL QUESTION ANSWERED.

Sir,—I did not intend to have noticed any proposition from Iver McIver, on account of his having so uncourteously, suffered a question, that I proposed, specifically to him, at page 69, vol. xxix, to remain unanswered. Had he answered that question, he must have, at the same time, unavoidably admitted his previous want of comprehension; but, to such an extent, it appears, his moral courage could not stretch. I shall, however, forget such want of candour, and proceed to explain the rationale of his question at page 139 of your present vol.

To enable the sun to rise, or set, simultaneously to any two places, he must, at that moment, be in the pole of a great circle passing through those places.

If the places be under the same meridian, he must, consequently, be in the equinox; but if they be not under the same meridian, then his declination, north, or south, must be equal to the angular distance of such great circle from a meridian.



To discover such declination, is a matter of very simple trigonometrical calculation. Let P, be the pole; S, the sun's place; C D, the equator; P E, P C, two meridians; and A, B, two places on the great circle C A B. In the triangle A B P, the sides A P, B P, are the respective co-latitudes of those places; and the contained angle P, is their dif-

ference of longitude: hence the angle at A is known. And in the right-angled triangle A E C, the side A E, being the latitude of A; and the angle at A being known; the angle at C is found, and consequently the declination required.

This declination will be—

North } when the sun { rises } To two places of which the northern is to the
South } when the sun { sets. } west.

There is, however, another condition essential to the proper fulfilment of the phenomenon. Not only must the sun be in the required declination on any day, but also at the very moment of sun rise, or sun set, on that day; and this would be a coincidence so extremely improbable, that its absolute fulfilment, except in theory, is next to impossible.

For the places named in the question at page 139, viz. Greenwich and Edinburgh (the correct difference of longitude being 3°. 11′); the declination of the sun at the moment of rising should be 13°. 14′. 53″ north: and the time, 4^h. 51^m. 11^s. A.M., Greenwich appt. time, not taking refraction into account.

To conclude, I beg to propose as a question—what are the situations of two places, at which it is possible that the sun should both *rise* and *set*, simultaneously, on the *same day*.

Your obedient servant,

NAUTILUS.

Leeds, Nov. 30, 1839.

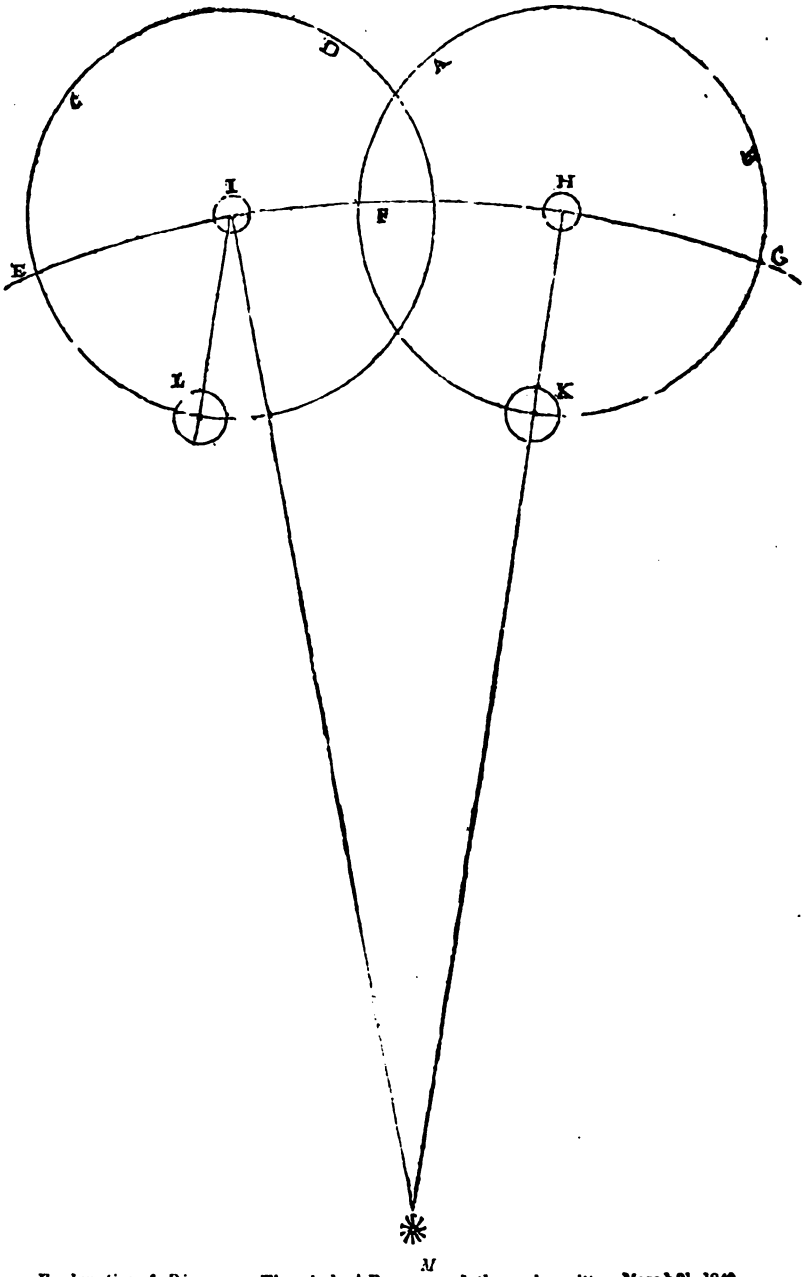
P.S.—In my communication of a mental time table at page 138, there is the following erratum, which must be rectified—

At page 138, col. 1, line 13, omit the passage beginning with the words "the two first," and ending, in the 16th line, with the words "two each," and in its place substitute the following:—

"Sunday, Monday, Thursday and Saturday, having two each, and the others one each,"

A NEW SOLAR SYSTEM.

Sir,—In addressing you on this subject, I consider that I am addressing a scrutinizer for an enquiring multitude. From a thorough examination by those who are fully possessed of infinite nicety of judgement, in many matters of importance to the enquiring world, it has always been held out that the attraction of one body towards another, is in a ratio, according to their qualities, and distances; consequently, if any body has by its superabundant quantity attracted any other of a smaller quantity, 20′—17″ ½ in the year 1839, and that continued attraction constantly be kept up, its force must be accelerated proportionably to the time of its nearer approach, equal to the continued square, of its nearer motion, to that. A body that moved 20′—17½″ in time, or 50″ of a degree in motion in 1839, would move more than 60′ 52½″ in time, and 2°—30′ in motion in 1840, and in 1841 increase in the same ratio; and this reasoning brought into my consideration the precession of the equinoxes; the cause of the difference between the *tropical* and the *sidereal year*. *And if the attraction* of redundancy of matter accumulated at the equator is the cause, as is doubtfully substantiated by all our previous astronomers and natural philosophers, how is it they do not follow the order laid down in respect to the increased ratio of attraction, by squaring the time and motion by the decrease of the distance, which according to the increased power of attraction, would bring the axis of the equator into the present position of the axis of the ecliptic, much sooner than the period allotted; and the axis of the equinoctial much farther from the north star than it is at present. Now as it has been already and ably demonstrated, that the whole of the heavenly bodies are held up, and their motions sustained by one another's attraction, and by their proportional gravitating on their common centres, so as to move according to their quantities after the projectile force was given, pray, why did not the sun receive that projectile force as well as the other bodies? I say, that if our earth was subject to the power of attraction by the sun and moon in consequence of the redundance of matter



Explanation of Diagram.—The circle A B represents the earth's orbit, March 21, 1839.

The circle C D represents the earth's orbit, March 21, 1840.

E, F, G, part of sun's orbit in 25,920 years.

H, sun's position, March 21, 1839.

I, the sun's position, March 21, 1840.

K, the earth's position, March 21, 1839.

L, the earth, March 21, 1840, arrived at its tropical year, having 50" to complete its sidereal year.

M, fixed star.

at the equator, the equinoctial and the ecliptic would have been blended together long before the present time. Now to obviate this apparent error I present to your readers my idea of a new solar system for their meditation which I hope will receive a favourable judgement from more able astronomers than myself.

A meriridian line on our earth in its annual course, moves from a fixed star or apparent fixed body in the heavens until that same meridian arrives to that star again in $365^d . 6^h . 9^m . 14\frac{1}{2}^s$; but the same meridian that started from that star, arrives at the sun in $365^d . 5^h . 48^m . 57$ seconds; which is $20^m . 17\frac{1}{2}''$ short of the sidereal year; consequently, our axis must either have fallen towards the sun, or the sun must have moved forwards in its orbit to meet the meridian line $50''$ of a degree, or $20' \; 17\frac{1}{2}''$ sooner, than in the preceding year it parted from it. Now as I have hinted before, the sun may as reasonably have an orbit as any of the other heavenly bodies. I shall here delineate it on a diagram as well as I can within the compass of your paper, describing one of his revolutions to be in 25,920 of our years, and lastly, as the sun in moving forward in its orbit meets the meridian on the equinoctial $50''$ of a degree before it arrives at the complement of the sideral year, it causes the signs apparently to move forward, by our earth's nodes, like the moon's nodes, shifting backwards contrary to the order of the signs.

I am, Sir, etc.

W. W. Heath.

Andover, Dec. 2, 1839.

P.S. I have no intention of entering into any controversy upon the subject of this article.

W. W. H.

PROPOSITION TO CROSS THE ATLANTIC IN A BALLOON.

Mr. C. Green has published the following statement of the grounds upon which he founds his assertion of the possibility of making a journey in a balloon from New York, across the Atlantic, to Europe. He states, that balloons inflated with carburetted hydrogen, or common *coal gas*, will *retain this fluid unimpaired in its* buoyancy, and very slightly diminished in quantity, for a great length of time; whilst, on the contrary, the pure hydrogen is so subtile a gas, and capable of so great a degree of tenuity, as to escape through the imperceptible pores of the silk, whether prepared in the ordinary manner, or by means of dissolved India rubber. These facts are the result of observations made during 275 ascents; on many of these occasions a smaller balloon has been filled by a neighbouring gas works, and has been brought a distance of five or six miles to fill that in which he intended to ascend, containing, in many instances, its contents nearly the same in quantity and quality for nearly a week. The aeronaut has travelled 2,900 miles with the same supply of gas, and could have continued its use for three months, if necessary. As to making a voyage from America to Europe, Mr. Green dates its possibility from the following facts:—On all occasions in which the balloons in which he or other aeronauts had gained an altitude beyond the lower current of air, or land breezes, they found one uniform current of air coming from the Atlantic, and blowing west, north-west, or west by north, whilst the under winds, from different causes, were blowing from points completely at variance with the above; the ascent of the machine into these upper currents is perfectly easy, and the same altitude may be kept for an indefinite time with equal facility. In 1836, Mr. Green made a proposition at Paris to cross the Atlantic in a balloon, when he received a letter from Admiral Sir Sydney Smith, confirming his observations as to the directions of upper currents, and in which that gallant officer states his conviction of the safety of the proposed undertaking, and his readiness to accompany the aeronaut from New York to Europe in his balloon. It must be kept in mind that a balloon is not borne along as is a ship, by the force of the wind, having to overcome the impediment interposed by passing through a denser element like the water, but is a body lighter than the air itself in which it floats, and is wafted at the same speed as the air itself travels, as if it were part of the moving body. The wide expanse of sea offers no impediment to the undertaking, and a machine as large as the Nassau balloon could easily be fitted up for the reception of three persons, and victualled for three or four months if necessary. The machine could be lowered to the earth and ascend as often as it pleased the voyagers, by the adoption of the same plans as those used in the voyage to Germany. Mr. Green, having established the facts of a current of air continually passing round the earth in the direction of west-north-west,

the capability of his machine to retain the carburetted hydrogen gas for an unlimited time, and of its power of sustaining itself in the air for weeks—under these circumstances, and trusting to the faith he has always endeavoured to keep with the public, as to claim their confidence on this occasion, offers to take upon himself to traverse the Atlantic from New York to England in a balloon to be constructed for that purpose, and that he will make the experiment without any reward for his exertions.

RECENT AMERICAN PATENTS.

[*Selected from the Franklin Journal for Sept.*]

Pistons of Steam Engines, *Ellis L. Horton, Hartford, Connecticut.*—My improved piston is of the kind which is intended in general to operate by means of an expanding metallic packing, but my improvement is not necessarily confined to those pistons with a metallic packing but may be employed in all cases where it is desired to cause the elastic force of the steam to act within the body of the piston, and force the packing against the cylinder. My improvement consists in the employment of two valves, one on the upper and one on the lower plate of the piston, when used in a vertical cylinder; each of these valves opening inwards so as to admit steam to pass in freely on either side where its pressure may operate, and to prevent its escape at the opposite side.

Fig. 3. Fig. 2. Fig. 1.

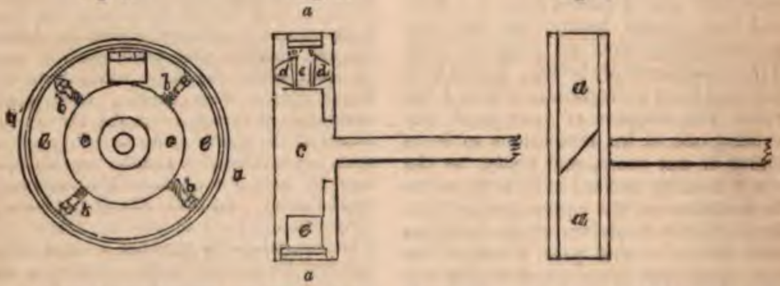


Fig. 1, in the accompanying drawing, is a side view of said piston for a horizontal engine. Fig. 2, is a vertical section through its middle, and fig. 3, a view of the interior, the front plate being removed: *a*, *a*, are hoops, or flat rings, of steel, or other metal, one within another, divided so as to allow them to adapt themselves by their elasticity to the interior of the cylinder; *b*, *b*, fig. 3, are set screws which are intended to keep the segments of the interior hoop, when divided into segments, in place, they are tapped into the hub, or centre *c*, *c*, of the piston.

In fig. 2 and 3, *d*, *d*, are the valves opening inwards, one of them only being shown in fig. 3; the other being attached to the front plate; *e*, *e*, is the chamber within the piston into which the steam is admitted, and within which it acts upon the interior of the packing, forcing it against the cylinder, and counteracting its tendency to pass between the two.

What I claim as constituting my invention, is the employment or two valves, one in the upper or front plate, and the other in the lower or back plate, of the piston, to admit steam on either side, in the manner and for the purpose herein set forth, without confining myself to the particular form of the valves, or to the position of the cylinder, whether vertical or horizontal.

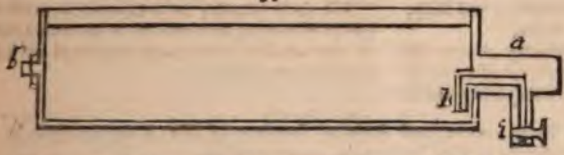
Steam Boiler, *Ellis L. Horton, Hartford Connecticut.*—The exterior form of my boiler is that of the ordinary cylinder, but within this I place what I denominate a movable steam reservoir, or chamber, which occupies a large portion of the space within the cylinder, but between which and the cylinder there is to be a stratum of water of three or four inches, more or less, which is exposed to the direct action of the fire upon the outer case, or cylinder; by which means, as experience has shown, the generation of steam is augmented, whilst the quantity of water to be carried is much diminished.

In the accompanying drawing 1, fig. shows the exterior of the boiler. Fig. 2, a side view of the reservoir. Fig 3 an end view of the same, and fig. 4, a cross section of the boiler, and of the reservoir within it.

Fig 1.

4

2.



3

The reservoir is suspended, centrically, within the cylindrical case, or boiler, by the shafts, or pivots *a* and *b*. The main body of it is cylindrical, as shown in the section fig. 3; on its upper side it is open from *c*, to *d*, which opening extends its whole length, and is of sufficient width to allow a man to pass into it from the man hole in the boiler, for the purpose of cleaning or repairing either the boiler or reservoir; there are projecting sides along the opening, as shown in the figures, and these are to rise so as nearly to touch the inside of the boiler. A concave lid, shown by the dotted line *e*, is hung on centres on one side, as at *c*, this is made of the same curvature with the reservoir, in order that it may be folded back within it, and occupy but little room. When raised up, it forms a channel to carry off any water which may foam over the sides of, and would otherwise pass into, the reservoir. A pipe rises from the lid *e*, and is shown by the dotted lines *f*; this prevents the running of water into the boiler through the opening, or openings, which must necessarily be left in it for the passage of steam. In boilers where the water does not foam, the lid *e*, may be omitted.

The shaft *a* of the reservoir is hollow, and passes through a stuffing box *g*, in the boiler head. It is made square at its outer end, where the requisite power may be applied to turn it round when required. A tube, or pipe *h*, *i*, passes through the hollow shaft, and is bent twice at right angles as shown in the drawing; it reaches down nearly to the bottom of the reservoir at *h*, and has a stop cock at *i*, by which it may be opened or closed at pleasure; by means of this device an opportunity is afforded of blowing off any water which may accumulate in the reservoir from the condensation of steam, or from any other cause. *j* is the steam drum, and *k*, *k*, the water space between the reservoir and the boiler. In each of these figures like parts are designated by the same letters of reference.

It will be seen that the close approach of the side of the open part of the reservoir, to the cylindrical boiler, will tend to prevent the passing of water into it, even where the foaming is considerable. I will remark, however, that if it is at any time preferred to use this boiler without employing the reservoir as a steam chamber, it may be advantageously done, water being allowed to rise in the reservoir to the ordinary water line of a boiler; and I have found that when so used steam is still generated with greater rapidity than in cylindrical boilers without such an appendage. When thus used the pipe *h*, *i*, may be employed as a supply pipe, and the water injected through it, will have much less effect in checking the supply of steam than when injected directly into the boiler.

Having thus fully made known the manner in which I construct my improved cylindrical steam boiler, I now declare that what I claim as my invention, and wish to secure by letters patent, is the construction and use of the moveable reservoir, suspended upon pivots, or gudgeons, and made, and operating, substantially in the manner herein set forth.

EXPERIMENTS ON THE TEMPERATURE OF THE EARTH AT VARIOUS DEPTHS.

[Extract from a Paper on the Temperature of Artesian Wells in Mid-Lothian, Stirlingshire, and Clackmannanshire, by R. Paterson, M.D., in the Edinb. New Phil. Jour.]

It was long ago advanced by M. Arago, that artesian wells were the only sure way of arriving at any correct data by which to judge of the increase of temperature as we descend in the crust of the earth. The temperature of mines had previously been much attended to, but the results were found so various, and the sources of fallacy so numerous, that no correct data could be based upon them with any confidence. In reviewing our experiments, it will be obvious that they bear upon two very important topics connected with this subject, and these are, *first*, the rate of increase as we descend, and *2dly*, the regular ratio which it bears.

This latter point is distinctly shown by observing that the temperature of artesian wells of small depth, and comparing them with those of great depth. Indeed, so much can this be depended on (at least in the districts we have examined), that on several occasions when individuals totally unacquainted with the subject have been told the mean of the district, and the usual rate of increase which had been found in other springs in that neighbourhood, as well as the depth of the spring we were about to examine, they have told the temperature very nearly.

The use, too, of the instrument before mentioned, renders our calculations upon the regularity of the increase very satisfactory.

We shall subjoin, in a tabular form, the result of our experiments on the temperature of the artesian wells, and the rate of increase as we descend.

List of the Localities, Temperature, and Rate of Increase of the Artesian Springs mentioned in Dr. Paterson's communication.

Name of Place.	Temp. of Spring.	Temp. of District.	Depth of Spring.	Rate of Increase.
	°	°	Feet.	° Feet.
Meadowbank..................	49½	46½	159	1 for every 53
Kerse.......................	51½	46	231	1 .. 42
Mumrills	51	46	213	1 .. 42.7
Loanside	48	46	100	1 .. 50
Kennetpans Distillery Bore......	51½	46	270	1 .. 49.1
Spring immediately under Mr. Bruce of Kennet's house	53	46	350	1 .. 50
The 4 springs here noted are in the immediate neighbourhood of Kennetpans, and quite close to the roadside	51	46	210	1 .. 42
	49	46	160	1 .. 53.1
	50¾	46	200	1 .. 42.6
	51	46	210*	1 .. 42
Parish of Slamannan *..........	48	45	180	1 .. 60
			Average	1 for every 47.11

A simple inspection of this table will show how very nearly the results of different localities approximate; and if we take the average number of these results, 1° for every 48 feet as we descend, we shall find that it comes very near the average, as fixed upon by the British Association, which is 1° for every 45 feet of depth. On comparing this table with the following, which has been drawn up from a variety of sources, but more especially from papers which are to be found in Professor Jameson's Journal, we shall find that the average of the former is much less than the latter, and this chiefly in consequence of some of the observations we have quoted having been made on enclosed waters at the bottom of old pits.

	°	Feet.
Rüdersdorf (Magnus and Erman), ...	1 in every	48.3
Later observations	1 ..	51.2
Still more recent	1 ..	54.1

* *Mr. Kincaid has furnished me with this observation, on which perfect reliance can be placed.*

* This is the supposed depth; accurate information regarding it could not be procured.

	°		Feet.
* Erzgebirge (Bischof), from observations on enclosed waters......	1	..	61.8
* Monk Wearmouth......	1	..	59.7
* Cornwall, from springs......	1	..	54.8
* Cornwall, from enclosed waters	1	..	52.7
* Uralian Mountains, from a comparison of the most authentic observations in these regions	1	..	55.4
* Rudersdorf, from rising springs	1	..	54.4
Paris, Well at Port St. Ouen	1	..	72.1
Departments du Nord, et du Pas de Calais...... Well of Marquette	1	..	61.
Departments du Nord, et du Pas de Calais...... Well of Aire	1	..	41.
Departments du Nord, et du Pas de Calais...... Well of St. Vincent	1	..	47.
Sheerness	1	..	41.
Tours......	1	..	41.8
Geneva (De la Rive et Marcet)	1	..	50.
Paris, Slaughterhouse of Grenelle	1	..	57.1
Average......	1 for every		53.1

ENGINEERING ESTABLISHMENTS OF MANCHESTER.

We extract the following interesting particulars relating to the magnificent establishments for the manufacture of stationary and locomotive steam engines existing in the manufacturing capital of the kingdom, from a well concocted book of the "guide" genus, entitled "*Manchester as it is.*" This work has the essential requisite of having its information of the most recent date and modern character, and is got up apparently not so much by compilation from other guide books, as from actual survey and examination. The engravings with which it is illustrated are well executed and faithful.

Steam-engine Making and Engineering.—One of the principal establishments in Manchester, in these departments, is that belonging to William Fairbairn, Esq., situate in Canal-street, Great Ancoats-street. To persons unacquainted with the nature of working in iron, an admission into these works affords, perhaps, the most gratifying spectacle which the town can present of its manufactures in this metal. Consequently, almost every person of distinction visiting the town contrives to procure an introduction to the proprietor before leaving it. In this establishment the *heaviest* description of machinery is manufactured, including steam-engines, water-wheels, locomotive engines, and mill geering. There are from 550 to 600 hands employed in the various departments; and a walk through the extensive premises, in which this great number of men are busily at work, affords a specimen of industry, and an example of practical science, which can scarcely be surpassed. In every direction of the works the utmost *system* prevails, and each mechanic appears to have his peculiar description of work assigned, with the utmost economical subdivision of labour. All is activity, yet without confusion. Smiths, strikers, moulders, millwrights, mechanics, boiler-makers, pattern-makers, appear to attend to their respective employments with as much regularity as the working of the machinery they assist to construct.

In one department mechanics are employed in building those mighty machines which have augmented so immensely the manufacturing interests of Great Britain, namely, steam-engines. All sizes and dimensions are frequently under hand, from the diminutive size of 8-horses' power, to the enormous magnitude of 400 horses' power. One of this latter size contains the vast amount of 200 tons or upwards of metal, and is worth, in round numbers, from 5,000*l*. to 6,000*l*.

The process of casting metal is conducted here on a very large scale. Castings of 12 tons weight are by no means uncommon: the beam of a 300-horses' power steam-engine weighs that amount. Fly-wheels for engines, and water-wheels, though not cast entire, are immense specimens of heavy castings. A fly-wheel, for an engine of 100-horses' power, measures in diameter 26 feet, and weighs about 35 tons. In this establishment some of the largest water-wheels ever manufactured, and the heaviest mill geering, have been constructed; one water-wheel, for instance, measuring 62 feet in diameter. The average weekly consumption of metal in these works in the process of manufacturing, owing to the quantity of wrought-iron used, and the immense bulk of the castings, is 60 tons or upwards, or 3,120 tons annually.

The preparation of patterns—wood facsimiles of the castings—is a very costly pro-

* *Copied and reduced from Professor Bischof's paper on Thermal Springs.*

cess. Every piece of machinery, before it can be cast, must be constructed in wood; and these *patterns*, as they are termed, are made to form, in sand, the mould into which the liquid ore is poured. Fifty men are daily employed in making patterns. The patterns, which are part of the proprietor's *stock in trade*, are worth many thousand pounds. After being used, the most important are painted and varnished, and laid carefully aside, in a dry room, to be ready for use when machines may accidentally get broken, or to aid in the construction of new ones. The patterns are made frequently of mahogany.

A most curious machine is employed for the purpose of *planing iron;* and, by means of its aid, iron shavings are stripped off a solid mass of metal with, apparently, as much ease as if it were wood, and with the greatest regularity and exactness. Not the least interesting department of these works is that appropriated to boiler making. Boilers, for steam-engines, are composed of a number of plates of wrought-iron, about ⅜ of an inch in thickness. They are rivetted together, with rivets about ⅝ of an inch diameter, holes to receive which are punched through the plates, by a powerful, yet simple, machine, with as much facility as if the resistance was mere air. The process of rivetting was, on the *old method*, an extremely noisy one; but a new plan is adopted here, and by it the work is performed silently and much more efficiently. Some time ago, about 50 boiler makers were employed by Mr. Fairbairn. They "struck," as it is termed, because their employer infringed, as they considered, upon their privileges, by introducing a few labourers, not in "The Union," to perform the drudgery connected with the work. On this occurring, Mr. Fairbairn and Mr. Robert Smith invented a machine which superseded the labour of 45 out of the 50 of his boiler makers. The work is performed by the machine much quicker, more systematically, and, as before said, without noise.

This extensive concern forwards its manufactures to all parts of the world. The stranger is told, on inquiry, that *this* article is for Calcutta, *that* for the West Indies; this for St. Petersburgh, that for New South Wales: and there are, besides, men belonging to it *located* in various parts of Europe, who are employed, under the direction of Mr. Fairbairn, in superintending the erection of work manufactured on these premises.

Many of the hands employed receive from 2*l.* to 3*l.* weekly wages, and scarcely any, except *common labourers*, receive less than 25*s.* per *week.** From these facts, some idea of the capital necessary to conduct a concern of this description may be imagined.

In addition to the above, Mr. Fairbairn has an establishment at Millwall, London, where upwards of 400 hands are employed in the manufacture of steam-engines, and in the building of iron steam-boats, and other vessels constructed of the same material.

In the Manchester establishment, Mr. Fairbairn and Mr. Eaton Hodgkinson have conducted various important experiments, which have been published from time to time in the "Transactions of the Manchester Philosophical Society," and in the "Reports of the British Association."

Locomotive Engine and Tool-Makers.—Under this head may be classed several extensive works in and about Manchester.* One of the largest is that possessed by Messrs. Nasmyths, Gaskell, and Co., situated at Patricroft, four and a half miles distant from Manchester, and immediately adjoining the Liverpool and Manchester Railroad, at that part where it crosses the Bridgewater Canal, which great national work forms the boundary or frontage of the ground on which the above establishment is erected, and which, in consequence, has been named, "The Bridgewater Foundry."

These works have a frontage to the railroad, as well as to the canal, to the extent of 1,050 feet; which circumstance supplies every possible facility for communication, either by land or by water carriage. One of the "stopping stations" of all the second class trains being opposite, persons desirous of visiting these works, can be set down at the entrance gate. The distance in *time*, from Manchester, is only from 10 to 15 minutes.

The above establishment is of very recent erection, having been in existence only about two and a half years. There are employed at present about 300 men; the greater part of whom, together with their families, live in cottages which the proprietors have erected for their accommodation. The situation of these works is not only most admirably adapted for the purposes for which they have been erected, but it also secures, in a great degree, good health to the men employed; for, being surrounded on all sides with green fields, and being, moreover, on the *west* side of Manchester, a very long lease of pure air is secured; a circumstance of no small importance, as regards the health and comfort of the workmen employed.

The whole of this establishment is divided into departments, over each of which a foreman, or a responsible person, is placed, whose duty is not only to see that the men

* *The total weekly wages* amount nearly to *one thousand pounds!*

* Messrs. Sharpe, Roberts, and Co.'s, Messrs. Peel, Williams, and Co.'s, are among the first in importance.

under his superintendence produce good work, but also to endeavour to keep pace with the productive powers of all the other departments. The departments may be thus specified:—The drawing office, where the designs are made out; and the working drawings produced, from which the men are to receive the necessary information. Then come the pattern-makers, whose duty is to make the patterns, or models, in wood, which are to be cast in iron or brass: next comes the Foundry, and the iron and brass moulders; then the forgers or smiths. The chief part of the produce of these two last named, pass on to the turners and planers, who, by means of most powerful and complete machinery, execute all such work on the various articles as require either of these operations; besides which, any holes that are required are at this stage bored, by a great variety of drilling machines, most of which are self-acting. Then come the fitters and filers, who, by means of chisels and files, execute all such work as requires manual labour, and perform such delicate adjustments as require the individual attention of the operative: in conjunction with this department is a class of men called erectors, that is, men who put together the frame-work, and larger parts of most machines, so that the two last departments, as it were, bring together and give the last touches to the objects produced by all the others. A machine having passed through these departments, is now ready for a coat of paint, which having received, it is taken to pieces, (after all the parts are marked, so as to enable its being put together when it arrives at its destination), the bright parts are smeared with tallow, and, if required, placed in packing-cases, which are then handed over to the foreman of the labourers, who, by means of the crane or railroad, place them in the canal boat or railway waggon.

With a view to secure the greatest amount of convenience for the removal of heavy machinery from one department to another, the entire establishment has been laid out with this object in view; and in order to attain it, what may be called the straight line system has been adopted, that is, the various workshops are all in a line, and so placed, that the greater part of the work, as it passes from one end of the foundry to the other, receives, in succession, each operation which ought to follow the preceding one, so that little carrying backward and forward, or sifting up and down, is required. In the case of heavy parts of machinery, this arrangement is found exceedingly useful. By means of a railroad laid through, as well as all round the *shops*,* *any casting, however* ponderous or massy, may be removed with the greatest care, rapidity, and security. Thus nearly all risk of those frightful accidents, which sometimes occur to the men, is removed. The railroad system is now beginning to be as much attended to, and its advantages felt in concerns of this nature, as it is in the transit of goods and passengers.

Nearly one uniform width is preserved throughout all the workshops of this extensive concern, namely, 70 feet; and the height of each is 21 feet to the beam. The total length of the shops on the ground floor, already built, amounts in one line to nearly 400 feet. There are, besides, four flats of the front building, each 12 feet high, 100 feet long, and 60 feet wide. Into these rooms a perfect flood of light is admitted by very large windows on the side walls, as well as through sky-lights in the roof.

The Foundry occupies one portion of this building, namely, 130 feet by 70 feet, in which great apartment or hall there is not a single dark corner; a point of vast importance where the operations are conducted with a black material, namely, the moulding sand. The iron is melted in one or more of four cupolas, according to the weight of the casting. The cupolas vary from three to six feet in diameter, and when all are in active operation, melt thirty-six tons of iron. The great cauldron, or pot, in which the metal is contained, is placed, during its transit from the furnace, on a carriage, which moves along a railroad in front of the four cupolas; and thus any portion of melted metal can be received and conveyed with the most surprising rapidity and ease to any point of the surface of this great hall. These great pots contain, at times, each six or seven tons of melted iron, and, by means of a crane, whose arms sweep every part of the foundry, are handed from place to place as if wholly devoid of weight. The crane posts are two great cast-iron columns, around which the crane arm swings, The columns serve at the same time as supports to the roof, and by proper ties, the strain of such great weights is diffused over the whole building, and each brick made to share the load. The *blast* of air for the furnaces is supplied by a fanner, five feet in diameter, made to revolve at the rate of 1,000 revolutions per minute, the air or blast being conveyed under ground in a brick tunnel, from which it is distributed to each furnace by sheet-iron pipes, varying from three to nine inches, according to the size of the furnace at work at the time.

There are at present 56 turning lathes, of all sizes, at work in this establishment, several of which are what is called self-acting, —that is, the work has only to be placed in the lathe, and the tool set, and the machine

* *Abbreviation of "workshops."*

does the remainder of the work with unerring accuracy and ease.

Planing machines are extensively used here. The immense power of one of these machines may be imagined, when it is considered that the amount of resistance against the edge of the knife which planes the iron is, in a large machine, as much as 30 tons. This fact leads to the consideration of the hardness of the instrument which has to encounter, for perhaps a day together without becoming inoperative, this immense resistance. By means of this admirable machine every variety of geometrical figure can be produced with the most absolute accuracy—such as the plane, the cylinder, the cone, and the sphere. And as all possible varieties of machinery consist merely of these figures in combination, there is now every facility for producing whatever may be required.

Besides the manufacture of every description of engineers' tools, another branch of business for which this establishment has been erected, is that of locomotive engines, a branch of business which is rapidly acquiring great importance, and which will have few rivals as to magnitude. Lancashire appears to be completely taking the lead in this manufacture, which, from its very nature, can be carried on only on a large scale.

From this establishment machinery is sent to all parts of the world. One of its customers is the Pasha of Egypt, who has had made here, for the use of his arsenal, a neat low-pressure engine. He intends employing it to bore cannon, which he finds still necessary, to keep his refractory neighbours in subjection.

NOTES AND NOTICES.

New Iron Steamer.—The largest iron steam-vessel yet built was launched on Saturday week, from Mr. Laird's yard, at Birkenhead, and hauled into the Clarence Dock basin, where her engines have been put on board. It is expected she will be ready for sea before Christmas. Her length is 165 feet, breadth of beam 29 feet, and tonnage, per admeasurement, 660 feet. She was built by Mr. John Laird, of Birkenhead, and her engines were made by Messrs. Forrester and Co.

New Glass.—The immense conservatory at Chatsworth is being glazed with a new description of glass, called patent flattened crown glass: by means of which, in the ridge and furrow mode of roofing invented by Mr. Paxton, a great improvement may be made in the construction of hot-houses. This glass is so much thicker than the common crown glass, that it is in no danger of being broken by hail-stones, and the panes may be made 40 inches long at the same cost per foot as ordinary sized panes.—*Leeds Intelligencer.*

Beet-root Sugar Manufactory in Scotland.—A correspondent informs us that last week he visited the sugar works at Macduff, near Banff, erected there last year by Mr. William Ingram for the manufacture of sugar from the sugar and white beets, and was much pleased with the cleanness and orderly arrangement of the whole thing. The establishment is but on a small scale compared perhaps with other works of the same kind in France and other countries, but this one is believed to be the first erection of the kind in Scotland, and though meant only as an experiment, yet the highest credit is due to Mr. Ingram, the proprietor, for introducing into our country, a new and useful branch of industry, and one which, if generally followed, would, to a certainty, render our country partly independent of foreign nations for the necessary article of sugar.—*Aberdeen Journal.*

The Portsmouth and Gosport Floating Bridge, which had been looked for some days past, was towed into harbour this day at noon, from Bristol, by the Sir Francis Drake steam-vessel, and will be immediately fitted for use. It is admirably constructed for the purpose it was designed for, and the advantages accruing from it, not only to foot and carriage passengers from all parts of the neighbouring counties, but to the inhabitants generally of Portsmouth and Gosport, will no doubt soon be experienced.—*Hampshire Telegraph.*

Sale of Mr. John Cockerell's Establishment at Seraing to the Russian Government.—The *Courier de la Meuse* has the following:—For some days past, a report has spread that agents appointed by the Russian government had been in treaty with Mr. J. Cockerell for the purchase of his magnificent establishment at Seraing. It was said that the bargain had been concluded at the price of 11,000,000 francs. To reconcile this report with the announcement of the sale of this establishment, fixed for the first of March next, it was given out that the Russian government had engaged, in case any advance should be made on the 11,000,000, to meet such advance. We see in the *Augsburg Gazette*, in the letter of a Brussels correspondent, that the price agreed for the establishment at Seraing did not amount to 10,000,000, and that the contract had been deposited at Aix-la-Chapelle. The same correspondent asserts, that, if any higher offer should be made before the first of March, the Russian government would meet such increased price. It is said that the models in the establishment, are alone worth 1,000,000 francs. It is expected that the Russian government will put the establishment into immediate action, under the superintendence of Mr. Cockerell.

Substitution of Paper for Metallic Plates in the Daguerreotype.—A new application has been made of the effects of the daguerreotype, by M. Bayard, a clerk of the French Finance Department. By the means of a chemical process he has succeeded in fixing the impressions of the camera obscura upon paper. The number of drawings thus obtained by him is very considerable, and among them there are about 20 which present great perfection. If the outlines of objects are not so clear in the impressions taken on paper as in those obtained upon the metallic plates, they have a softness in their general effect which is highly pleasing to the eye. Moreover, the paper, which may receive any colour, has not the inconvenience of the mirage which attends the silver-gilt plates. The section of the fine arts of the Royal Institute, to whom M. Bayard has submitted the drawings he has obtained, have been struck with the extraordinary delicacy with which the objects are reproduced upon the paper; and a most favourable report, drawn up on this new application of the daguerreotype, by M. Raoul Rochette, will shortly be published in the *Moniteur.*—*Paris Paper.*

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE

No. 854.] SATURDAY, DECEMBER 21, 1839. [Price 3*d*.

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WHITELAW'S MACHINE FOR GRINDING THE RIMS OF PULLIES.

Fig. 1.

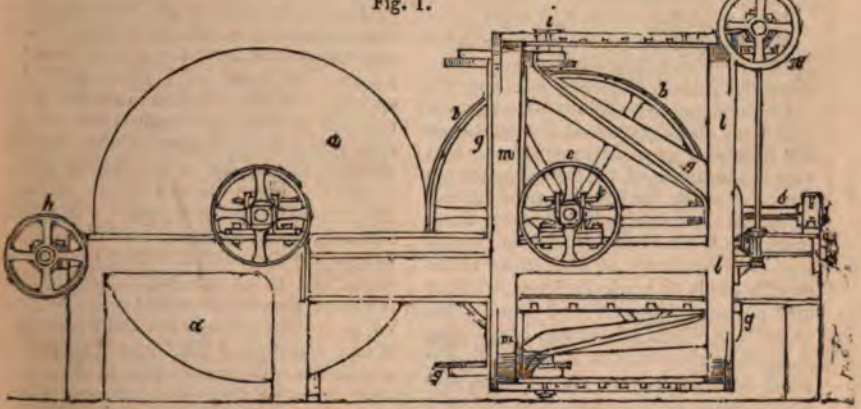


Fig. 2

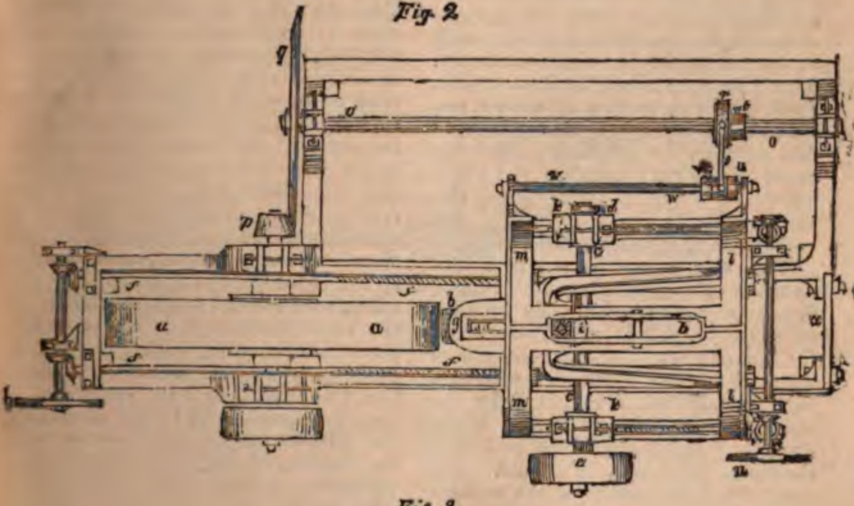


Fig. 3.

... the stone, it always keeps in good order:

As the crank is made forked, and as the part *o o* has a groove in it open at

DESCRIPTION OF A GRINDING MACHINE WHICH IS USED INSTEAD OF A TURNING LATHE, FOR GIVING A TRULY CYLINDRICAL FORM TO THE RIMS OF PULLEYS AND DRUMS:—ALSO OF A MACHINE FOR GRINDING PULLEYS ROUND ON THE RIM. BY MR. JAMES WHITELAW.

[*Communicated to the Society of Arts for Scotland.*]

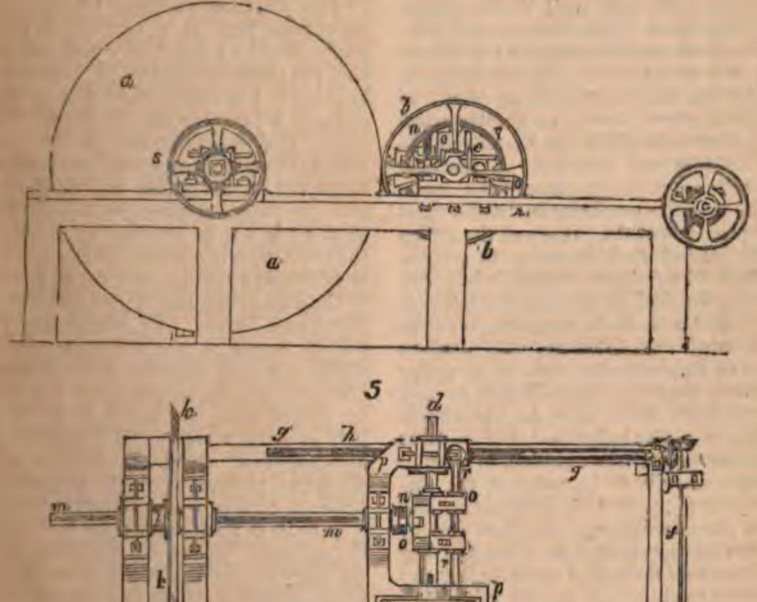
Gentlemen,—Mr. Edward Sang, in his paper on the Progress of Exactitude in the Manufacture of Machines, has given you an account of the latest improvements made on the turning, planing, and screwing machines. But besides these machines there is the grindstone, which has been fitted up of late, so as to do certain kinds of work in an expeditious and accurate manner, and from some experience which I have had in working it, I am of opinion that it might be applied to a greater variety of work, and much more extensively than it has ever yet been. I will *first* give you an account of a machine planned by me for grinding pulleys or drums *truly cylindrical* on the rim, which has been much in use during the last eighteen months. After I have described the first machine, I will give you an idea of *another* machine, which has never yet been brought into practice, for grinding pulleys, &c. *round* on the rim; and then you will, I believe, be of opinion that grinding machines might be used to great advantage in factories where mill-gearing is made.

Fig. 4, (opposite page,) is a side elevation of a machine for grinding drums or pulleys of a truly cylindrical shape, or, as it is called, straight on the rim, and fig. 5, is a ground-plan of the same machine. The parts which are seen in both figs. are marked by the same letters in the one fig. as in the other; *a a* is the grindstone, and *b b* is the pulley which is to be ground. The pulley *b b* is fastened upon the mandril *c c*, this mandrel is fixed into the spindle *d d* at the one end, and it works into a plummet-block *e* at the other end. The speed of the grind-stone is 180 revolutions per minute, and the pulley *b b* makes 130 revolutions in the same time; the stone and pulley revolve in the same direction, in order that the parts in contact may rub upon each other at the combined speed of their circumferences. gives motion to the screws *g g*, *g g*, *g g*, in connection with the plummer blocks, into which the spindle *d d* and the mandril *c c* work. As the plummer-blocks slide upon the rails *h*, *h*, *h*, which form part of the framing of the machine, in a similar manner as the parts of a slide-rest move, and as all the screws marked *g g* have the same pitch of thread, the spindle and the mandril are shifted at once, either from, or towards the grindstone, and keep always parallel to its shaft, if the handle or wheel *u* is moved by hand. Upon the end of the shaft of the grindstone, a bevel pinion *i* is fixed, and this pinion gears into the wheel *k k*, fixed upon the shaft *l*. The shaft *l* is bored out to fit the shaft *m m*, which is turned parallel the whole of its length, so as to slide through the shaft *l* easily. There is a feather fixed into the shaft *l*, which fits the groove planed into the shaft *m m*, so that this shaft can slide through the shaft *l*; but it cannot revolve unless the shaft *l* carry it round. Upon the end of the shaft *m m* a small crank *n* is fixed; as this crank has a perpendicular position in the figs. it is not so distinctly seen. The crank pin has a brass on it, which slides into a groove running in a perpendicular direction in the part *o o*. As two sets of the bushes in the part *o o* work upon journals cut into the spindle *d d*, if the grindstone revolve, the spindle *d d* and the mandril *c c* will work endways, at one time in one direction, then in another, so as to bring an end of the pulley *b b* past a side of the stone, once for every half revolution of the crank shaft; and, in this way, the pulley and the stone, as they wear, keep perfectly cylindrical. It will be evident that the mandril and the spindle have no ruffs, and they are turned parallel at the parts which slide and revolve into the plummer-blocks. The bracket *p p*, which supports the crank-shaft, is fixed upon the two plummer-blocks for the spindle *d d*, and, on this account, if they are moved, from or towards the grindstone, it is carried along with them. The pulley *q*, which drives the spindle *d d*, is connected to it (the spindle) in a similar way as the shaft *m m* is connected to the shaft *l*, and the part of the bracket *p p*, seen in the ground-plan passing nearly round this pulley, keeps it always at its proper place. The small rod *r r* serves

always in a perpendicular direction. *S* is the pulley which drives the grindstone.

The machine now described grinds fifteen pulleys of 18 inches diameter by 5 inches broad, in a day, working ten hours; now this is a great quantity of work, considering the very moderate speed at which the parts are driven. When a pulley is finished, if a planed malleable iron straightedge is applied on he rim parallel to its axis, it touches the ley in every part. After the pulley is ground, it is shifted back from the stone and still kept revolving, then a stick with a little emery and oil on it is pressed against the pulley, and this gives it a fine polish. A grindstone for finishing pulleys is not anything like so expensive to make as a turning lathe: it does incomparably more work, and it does it as well as any self-acting lathe; besides, when the iron is hard, which is frequently the case in thin pulleys, a lathe is good for nothing, and this makes no difference in a grinding machine: a grinding machine

Fig. 4.



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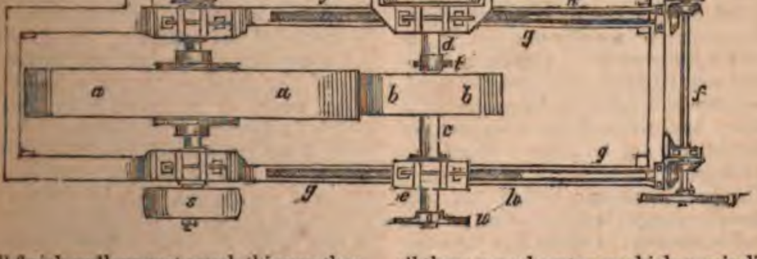

will finish pulleys cast much thinner than any that can be turned; this is a saving of metal: from the manner *in which the ends of a pulley work past the sides of the stone, it always keeps in good order*: all these are advantages which a grinding machine has over a lathe, in finishing pulleys or drums.

As the crank is made forked, and as the part *o o* has a groove in it open at

both ends, for the bush of the crank-pin to work into, the crank-pin can easily be taken away by unscrewing the nut which holds it to the crank, and then the spindle *d d* will not be wrought endways by the motion of the crank. When the ends of a pulley are to be ground, the crank-pin is taken away and a pincing screw is fixed upon the rod *r r*, which acts upon the part *o o*, so as to press the spindle *d d* on end, the one way or the other, as required; then if the pulley is shifted past the side of the stone, the pincing screw will press its end against the stone, and, if the machine is kept in motion, the end of the pulley will be ground. Having the crank forked answers another purpose; it allows the pin to be shifted further from, or nearer to, the centre of its shaft, in order to give a longer or shorter range to the motions which the crank gives to the spindle and mandril. A machine for grinding drums should be made wider than the one shown in the sketch, at the place where the stone and the pulley to be ground work, in order to get the ends of a long drum ground, when they are not finished in the turning lathe, at the time the drum is chucked, to get its eye bored out. Perhaps the simplest way of finishing the ends of a pulley which is bored out in the eye, is to do it in the lathe when it is on the chuck. When a pulley is finished, and it is to be taken out of the machine, or when a rough pulley is to be put into the machine, the cutter *t* is driven out, and then the mandril *c c* is drawn on end by means of the handle *u*, after the key which holds the pulley upon the mandril is slackened. Any of the plummer-blocks which guide the spindle *d d* and mandril *c c* can readily be taken away, and a larger or smaller one put in its place; by this means a spindle or mandril to suit any sort of job may be used. The stone is covered in by means of a wooden box, so that the water used in grinding may not be thrown about the workshop.

The machine shown in figs. 1, 2, and 3, (see front page) is for grinding pulleys round on the rim; in all the figs. the same letters point out the same parts. *a a* is the grindstone; *b b* is the pulley to be ground; this pulley is fastened upon the mandril or spindle *c c*. When a pulley to be ground is put upon the mandril *c c*, or when a finished pulley is to be taken off this mandril, the pincing screw *d* is slackened, and then the ruff into which it is screwed gets loose upon the mandril; after this the mandril is drawn on end, so far as that a pulley may either be taken off, or put upon it, by taking hold of the pulley *e* which gives motion to the mandril. The two screws *f f*, *f f* work into nuts fixed into the bracket *g g g g*, and by moving the handle or wheel *h*, the pulley to be ground is pressed against the stone, or shifted away from it as is wanted. The bracket *g g g g* has two pins or gudgeons *i i* fixed on it, and the frame *l l m m* turns upon these pins as a centre. When a pulley is to be ground very flat on the rim, the plummer blocks *k k* are shifted as close to the rail marked *m m* as they can get, by turning the handle *n*. The closer that the plummer blocks, into which the mandril *c c* works, are brought to the rail *l l*, the pulley will be ground with the more curvature on its rim. The shaft *o o* is set in motion, by means of the bevel wheels *p* and *q*; this shaft has an eccentric *r* upon it, which, by means of the connecting rod *s*, gives motion to the frame *l l m m*. By slackening the pincing screw *t*, the eccentric may be shifted along the shaft *o o*, and by slackening the pincing screws *u* and *v*, it may be shifted along the rod *w w*, so as to give as much travel to the frame *l l m m* as is required. As the frame *l l m m* is always in motion, it might perhaps be better to have a guide round the pulley *e*, in order to keep the belt on it. After the plummet blocks *k k* are brought to the place on the rails of the frame *l l m m*, which gives the pulley its required curvature, the machine is set in motion, and the pulley is pressed against the stone by means of the handle *h*. In order to get a very large pulley put into, or taken out of the machine, the rail *x* must be taken away, by unscrewing the bolts which fix its ends. In the bracket *g g g g*, each of the parts which hold the pins *i i* has a slit in it, so that, by unscrewing the nuts *y y*, the pins may be shifted to any end of the slits. One of these slits is seen in fig. 2; it has a check round it to receive a shoulder formed upon the pin. In the frame *l l m m* each of the parts which hold the bushes for the pins *i i*, has a slit formed, so that the bushes can be fixed on either end of it; there

itter holes placed so that the bushes iave other positions, besides at the of the slits. When the bushes are xed at any of the ends of the frame , a gib, as shown in fig. 2, is pass-rough a set of cutter holes; after he brasses are brought up against l fixed by means of the same cutter fixes them at the ends of the slits. ving the slits for the pins in the et *g g g g*, and the slits for the s in the frame *l l m m*, allows the pon which the bracket *g g g g* slides, ll as other parts of the machine, made much shorter than they could de without them, and some sizes lleys could not be ground at all at these slits. The use of the slits bracket *g g g g* is to allow the il *c c* in every position to work of the part of this bracket, which n upright direction fig. 1. The holes in the frame *l l m m* must be so that, in whatever place in the ie bushes are shifted to, the rails *m m* will have an upright position, iew, as per fig. 1; and when the i are shifted to the different ends slits, in the bracket *g g g g*, from they are shown in the figs., these f the frame *l l m m* must have an it position, in a view, as per the evation. It will be seen that fig. 3 a complete end view, but is only ed to show some of the parts.

he smallest speed of a cone was in the form of a pulley, with a cast inside of its rim close to one nd then, if the next larger speed was thout arms, but having two flanches, each end of its rim, the parts now of could be fixed together so as a cone of two speeds, by means s passing through the flanch on all speed, and one of the flanches large speed. On the principle plained, a third speed could be pon the cone, then a fourth, and till the required number of speeds it upon it. In a cone having a many speeds, the largest speed be cast with arms and a centre, ie as for the small speed. A cone construction could be ground machine, as last described, by ing it into speeds, and grinding allest one first; then the second t speed could be ground after it ted upon the smallest speed, and so on, grinding one speed after another, till the cone is finished. If cones were to be finished upon a grinding machine, it would require to be made wider than the one to be shown in sketch No. 2.

I am, gentlemen, yours respectfully,

James Whitelaw.

Report of the Committee of the Society on Mr. Whitelaw's Machine for grinding Cast-iron Pulleys.

Your committee, having attentively considered the drawing and description of this machine, are of opinion that it will produce the required effect. They imagine, however, that there is a considerable defect in the arrangement of the relative positions of the grindstone and of the drum or pulley to be ground. The communication is one of very high merit, and relates to a subject every day becoming more important; the committee, therefore, consider it worth while to criticise minutely the point referred to.

In Mr. Whitelaw's arrangement the axes of the drum and of the grindstone are parallel to each other. Two inconveniences result from this:—In the first place there is created a tendency in the drum to follow the motion of the grinder, which causes an undue, though not very considerable, strain on the band or belt which leads the drum. In the next place, there is a tendency to streak the surface. It is true that arrangements are made to shift the drum length-ways upon the stone, so as to equalize the wear, and to shift the positions of the streaks, but this, in the opinion of your committee, will merely palliate, not effectually correct, the evil. If the axes were placed at right angles to each other, both of these evils would be removed; and if, in addition, the motion of one or other shaft were reversed at intervals, a surface would be produced superior both in general accuracy and in finish. The streaks then would cross each other obliquely on the drum, and the ultimate result would be a very *flat* surface; of this, one of your committee has had abundant experience.

Mr. Whitelaw's proposed method of rounding pulleys would, no doubt, answer perfectly; indeed, there appears to be no distinction in principle, and as little in practice, between the machine for giving a straight, and that for giving a circular outline; here, also, the cross-

ing of the two motions ought to be attended to; were that done, there would probably be no use found for oil and emery afterwards.

On the whole, your committee beg to recommend this interesting communication to the attentive consideration, and favourable notice, of the Society.

EDWARD SANG, Convener.
WALTER NICOL.

Edinburgh, July 18, 1838.

HYDRODYNAMIC RAILWAYS.—IMPROVEMENT IN CANAL TRANSIT.

Sir,—In your excellent publication, vol. xxiii., there is a very interesting article headed "Hydrodynamic Railway," the production of Mr. Herron, of North America.

The writer of the article recommends the use of water wheels as a cheap method of transport upon railroads or ashler stone roads. I have spent many hours and days in studying the subject, and I am of opinion he is quite right, except on one point, viz., the allowance to be made for the friction of the rope. He supposes 600 lbs. a power sufficient to overcome the friction of a rope four miles in length running upon rollers; that is, two miles of road, with a double or endless rope; the loads being 50 tons and moved at the rate of 10 miles an hour: in this case the friction of the rope would be much more than 600 lbs. By referring to a book published in Liverpool in the year 1830, by Robert Stephenson and Joseph Locke, civil engineers, at page 47 it is stated that the friction of a rope one mile in length is 382 lbs.; and, of course, for four miles 1528; the circumference being $4\frac{1}{2}$ inches, and the weight of four miles 18,368 lbs., the friction being 1-12th of the weight; and the loading is proposed to be 52 tons.

It is scarcely necessary to say that this thickness of the rope would do for either a load of 50 or 52 tons. The stages proposed on the Liverpool and Manchester Railway on the level part of the line were to be one mile and a half, and the loads 52 tons each.

The book before mentioned was written to prove that locomotive engines were *preferable to stationary* engines and *ropes. The latter method* had been recommended by two other eminent engineers.

To put down for friction of carriages 10 lbs. per ton is very proper, although the experimentors of late, say on a new railway, it is less than nine.

For gravity there is a very liberal allowance, and intended for an irregular section.

I propose that the load shall first run half a mile upon a level railway, and then ascend the remainder of the two mile stage 15 feet, which would be three feet higher than the water wheel, and admit of a fall for the water to run from one stage to another, the fall of water being 12 feet.

I will now proceed to calculate how much water would be required to draw the train two miles with an endless rope, the weight, including the carriages being 50 tons, to run level half a mile, and the remaining mile and a half to rise 15 feet.

Gravity of 50 tons on a plane 7920 feet long and 15 feet high, $112,000 \times 15 \div 7920$	212
Friction of rope as before described, length four miles	1528
Friction of the load 50 tons—	500
	2240

	lbs.
Two miles are 10,560 feet, $10,560 \div 12 \times 2240 = \ldots$	1,971,200
Add for waste water........	985,600
	$62\frac{1}{2}$) 2,956,800
Cubic feet of water........	473,088
One lock $100 \times 15 \times 12 = ..$	18,000

$473,088 \div 18,000 = 26$ nearly.

Explanation of the foregoing:—

2240 lbs. is the power required to move the 50 tons, and the ropes up the plane the length of 12 feet, supposing the water to fall in a body so far.

$10,560 \div 12 = 880$. Then 880 is the number of times that 2240 lbs. water must be applied to move the load two miles, and $2240 \times 880 = 1,971,200$, which is the quantity of water required to move the load two miles, except what is to be added for waste, which is a point on which men are not all agreed; but if half be added, it will probably be a little more than enough, and will be 2,956,800 lbs.

$62\frac{1}{2}$ lbs. are one cubic foot, and 47,308 the cubic feet of water required to move

oad two miles with a double rope, as osed by Mr. Herron. This being 26 -full, can only be used where the tity of water is very abundant, the ly being from a river.

e time for moving the load two being 12 minutes, the quantity of r flowing in one minute would be cube feet, and in one second 65 ths, and if the velocity of the wheel e periphery be four feet per second, each bucket should contain 16 ths cube feet, which is far too much, s not practicable; therefore the load tons should be reduced to 25 tons, hich case the rope need not be so g or heavy; and a water wheel buckets holding less than eight cube would answer, and the power of a wheel would be 30 horses, ascer- d thus :—First divide 1,971,200, the ds of water before mentioned, by and this number by 12 minutes will uce the quantity of water to flow minute, in order to move 25 tons up lane; this is to be multiplied by the 2 feet, and divided by 33,000, gives horse power as above stated.

e foregoing is written with a view xamining and to comment on the theory of James Herron, which he invites others to do. He also recommends the use of water wheels, to be placed in a canal lock, and the waggons to run upon the towing path made wide, with an ashler paving, and I have made some calculations on the subject, and find that if the water now used on the Huddersfield canal, in passing boats through locks, were to be applied to water wheels, and a railway made on the towing path, that three times the business could be done, that is now done; and as the time would be reduced to one-third of the time now required, the business upon the line would be about three times as much as it now is; as the speed also would be much quicker than that of the stage coaches, the proposed conveyance would have the preference as a conveyance for passengers. The Huddersfield canal locks are supplied by reservoirs, made on very high ground, to hold rain water running into them. They supply the summit level on an average daily with more than 7000 tons of water, which is drawn from it to pass boats laden with less than 600 tons.

SENEX.

Manchester, Dec. 10, 1839.

OMPARATIVE EXPERIMENTS ON PROPELLERS OF DIFFERENT KINDS.

BY GEORGE RENNIE, ESQ., C.E.

r,—Having now completed the whole e experiments on the comparative ts of different kinds of propellers for ing vessels through water, I no er hesitate to communicate them to

e experiments were made in three rent ways.

t. By means of a model.

. By means of a row boat.

d. By means of a small steam-boat.

In the first case the model was placed in a trough of water, in which the surface of the water could be raised or lowered to any requisite height, and a pulley being fixed on the axle of the wheel, enabled it to revolve by the descending of a weight through a given height, so that the time of its descent became an index of the resistance. The following are the average results of the experiments :—

men-ons heel.	Time in falling of a 4lb. weight.	Area of floats immersed sq. inches.	Weight suspend-ed.	Area of one float.	Number of Floats.
2	15′.5	12	4lbs.	6	16 rectangular floats.
2	15.1	9	4	3	16 trapezium-shaped floats.
2	32″	12	4	6	16 rectangular floats immersed double usual depth.
2	16	9	4	3	16 Ditto.

Conclusions.—From the foregoing experiments, it appears, 1st, that the trapezium-shaped float, having only $\frac{1}{3}$ of the breadth and $\frac{1}{2}$ of the area of the rectangular float, has an equal resistance.

2d. That when both kinds of floats are immersed to double of their ordinary immersion, the resistance of the trapezium float is only $\frac{1}{2}$ of the rectangular float.

If this remarkable property of the latter, of working nearly as well under water as when plunged to the usual depth, holds good on a great scale, the difficulties experienced by steamers in the early period of their voyage, when deeply laden with coals, and when the engines can only make half their usual number of strokes, is overcome, and their voyages are likely to be considerably shortened.

2ndly. The experiments made in the different kinds of propellers on a row boat, having been made under equal circumstances, as to the magnitude, weight, and area of the boat's midship section, and with uniform magnitudes and areas of the propellers, and power to put them in motion, were as follows:—

Table in which are compared the Performances of the Screw-propeller, Conoidal-propeller, and Paddle-wheels, in the Grand Surrey Dock, made in the months of August and October: the Boat was worked by two men turning a winch.

Distance in feet travelled.	Time in seconds.	Revolutions of winch.	Revolutions of winch per minute.	Speed of boat in miles per hour.	Conditions of Experiment.
660.	201.0″	140.7	42.0	2.2	Screw-propeller, 17 inches diameter, 226 inches area.
660.	135.5″	89.6	39.6	3.3	Conoidal-propeller, 17 inches diameter, 144 inches area.
660.	155.25″	108.25	41.8	2.8	Paddle-wheel with 12 rectangular floats, each $9\frac{1}{2} \times 4 = 38$ square inches; six floats immersed = 228 sq. inches.
660.	153.5″	121.75	47.5	2.9	Paddle-wheel with twelve trapezium-shaped floats, acute angle down, each $\frac{9\frac{1}{2} \times 4}{2} = 19$ square inches; area immersed = 107 square inches.
660.	155.75″	120.75	46.5	2.8	Paddle-wheel with twelve trapezium-shaped floats, obtuse angle down, each $\frac{9\frac{1}{2} \times 4}{2} = 19$ square inches; area immersed = 103.8 square inches.

N.B. Dimensions of boat used in above experiments, 5 feet wide, 27 feet long, and 1 foot 10 inches in depth; weight of boat, ballast, &c., 2,828lbs.; area of midship section of boat's immersion, 483 square inches.

Conclusions.—That with reference to area, the trapezium-shaped paddle-wheel is superior to the rectangular; but that the conoidal-propeller, taken without reference to area, exceeds all the different kinds. The principal objection to the propellers working under water, arises from the great velocity which must be given to them, and the complicated machinery necessary to produce it.

3rdly. The experiments of the two kinds of paddle-floats in a steamer. The following is—

Average of Experiments made on Paddle-wheels with the "Pink" Steam-boat, made at the West India Import Dock, in November last.

Distance in feet travelled.	Time in seconds.	Revolution of winch.	Revolution of winch per minute.	Speed of boat in miles per h.	
1320	138″	36.5	84	6.7	Wheels fitted with rectangular floats, $23 \times 9 = 207$ square inches; area of floats immersed, 635; extreme diameter of wheel, 7.4.
1320	145.75″	36.0	87.5	6.34*	Wheels fitted with trapezium-shaped floats (acute angle down), $\frac{18 \times 11\frac{1}{2}}{2} =$ 103.5 square inches; area of floats immersed $= 432.25$ square inches; extreme diameter of wheel, 8.10.

Conclusions.—The conclusions to be derived from the last experiment, are important.

1st. That with one-half of the area and one-third of the width, the trapezium-shaped propeller presented the same resistance as the rectangular float, while from its peculiar form the total immersed area was two-third of the immersed area of the rectangular float.

2ndly. That on account of this form it enters the water without shocks and vibrations as in the case of the common float, and leaves the water without carrying up a large portion of it like a cascade, whereby a considerable portion of the power is expended uselessly.

3rdly. That the width of the paddle-box, and, consequently, the resistance of the wind, one-third will be diminished.

4thly. That the lateral undulation and consequent tear and wear and danger to the engines, by the constant plunging in and out of the water, will be in a great measure obviated.

5th. That one-half the weight and present cost of paddle-wheels and boxes will be saved, while the vibratory motion, so disagreeable in most steamers, will be done away with.

Trusting that the foregoing will be sufficiently explanatory,

I remain, Sir,

Your obedient servant,

GEORGE RENNIE.

London, 12th December, 1839.

GILBERT'S IMPROVED GAS STOVE.

At the Bath Instruction Society last week, the Principal, Edward Osler, Esq., late of Falmouth, delivered a lecture to the Associates on the different methods of warming and ventilating buildings, in the course of which he called their attention to a gas stove, on a new and improved principle, which has just been fixed in the school-room of the City Commercial School. The common gas stove is merely a covered cylinder of iron, containing a hollow ring communicating with the gas pipe, and pierced with minute holes, from which the gas burns in small jets. The products of the combustion, mixed with a portion of gas, (for the gas is never wholly consumed when burnt in a jet) are discharged into the room, the air of which is thus rendered very unpleasant, and even unwholesome; hence the use of these stoves is confined to halls and shops where there is a very free ventilation. In the improved gas stove these evils are entirely avoided. The gas is first mixed with a sufficient proportion of atmospheric air to ensure its complete combustion and then passes through a plate of wire gause, on the surface of which it burns with a flickering blue flame. The combustion takes place within an oblong iron box, which is thus heated sufficiently to diffuse a soft and equable warmth through the apartment. A pipe carries off the vapour into the chimney. No inconvenience or risk whatever is connected with the use of the stoves, and the fire can be lighted or extinguished with the same facility as a common burner. This consideration, with the perfect freedom from dust and the avoiding of all trouble in keeping up the fire, makes the stove particularly desirable for a school-room. It also promises to afford an easy, cheap, and effectual means of warming a conservatory or hot-house; and it may be conveniently introduced into dwellings, for in addition to its use in warming the apartments, it may be employed, to a considerable extent, for cooking. The stove fixed in the Bath City School was made by the inventor, Mr. Ed-

* This small difference arises from a small portion of the float having been obliged to be cut off on account of an iron stay interfering.

ward Gilbert, Civil Engineer, &c., of Falmouth, and was exhibited last month at the annual exhibition of the Royal Polytechnic Society of Cornwall. Any person wishing to see it may be gratified by calling at the school-room.—*Bath Chronicle.*

THE EARLIEST PRINTED NEWSPAPER.

It has always been a difficult task to settle points of priority in discoveries and improvements. Take the art of printing, for instance, and it will be found that there is no absolute certainty as to the real discoverer of any new process, from the very first origin of the art down to our own days of stereotype and steaming. That the same uncertainty has also attended the *productions* of the press, an illustration is supplied by a pamphlet which has recently appeared,* the object of which is "to demonstrate that the claims of the English to the invention of printed newspapers are unfortunately of no validity." There are, probably, few readers of the *Mechanics' Magazine* who have not met with the assertion, till now uncontradicted, that, although written newspapers may have been invented by the Italians, the first *printed* journal was issued in our own country, pending the threatened descent of the Spanish armada, and under the superintendence of the profound and sagacious Burleigh. We are sorry to assure them that the facts brought forward in this pamphlet are amply sufficient to overthrow this theory, and to prove that the supposed genuine specimens of "*The English Mercurie*," preserved in the British Museum, are neither more nor less than downright forgeries.

The proofs brought forward by the author (who made the discovery) are strong and clear. The printed papers, it appears, are in a type so modern, that the idea of their belonging to the time of Elizabeth is out of the question, and, singularly enough, in the archives of the Museum are also preserved certain MSS. which had evidently constituted the "copy" followed by the printer, and which are very ingeniously traced as of no older date than the early part of the last century. Finally, the test of comparison with contemporary chroniclers is applied, and the "*Mercurie*" found wanting on this score also. A vast number of minor corroborative proofs are introduced in the course of the investigation, all contributing to make out a clear case, and of themselves so cogent, that it is probable, even had not the irresistible MSS. come to light, Mr. Watts would have been enabled to expose the fraud almost as convincingly as he has done with its powerful assistance.

Thus has perished an imposture which had met with the most extraordinary success, during the whole of the half century that had elapsed since the claim was first set up by Mr. George Chalmers, the antiquary, and which, it seems, has taken in not only our own grave encyclopædists, but those of many other countries also. For, as our author informs us, "the Conversations Lexikon of Brockhaus, and the Neuestes Conversations-Lexikon of Wigaud, mention it (the *Mercurie*) under the article *Zeitung;* the Dictionnaire de la Conversation et de la Lecture, under the head *Gazetier;* the great Russian Entsiklopedicheskii Leksikon, under that of *Gazeta;*" while it is noticed also in the Encyclopædia Americana, published at New York, and, doubtless, in many other publications of equal calibre. "There could hardly, in fact," observes Mr. W., "be any circumstance in literary history apparently established on a firmer foundation than this. A statement originally made on respectable authority, and repeated by so many others, was supported by a reference to a document preserved, not in a private library, or in one difficult of access, but in the most public, the most easily accessible, the most universally frequented collection in the capital. Any doubt or suspicion that might arise could be confirmed or dispelled at once, by applying for the volume, which was daily within call of hundreds of literary men, both English and foreign." Under such a state of things, who could have anticipated that such a claim as the one in question would have remained unchallenged for so long a period as from 1796 to 1839?

* A Letter to Antonio Panizzi, Esq., Keeper of the Printed Books in the British Museum, on the reported Earliest Printed Newspaper, "The English Mercurie, 1588." By Thomas Watts, of the *British Museum, London.* Pickering, 1839. 8vo. *pp. 16.*

It is, perhaps, not unworthy of observation, as illustrative of the march of liberality, that the discovery, so fatal to an English pretension of some consequence, is at length made known in a letter from an Englishman to an Italian, that Italian being at the head of the department of our National Museum where the supposed literary treasure was deposited, and whence the proofs of its spuriousness have been drawn. We could have wished that our author's task had been the more genial one of unveiling hidden merit, instead of hidden imposture, but we think with him, that "the English nation, and the British Museum, are too rich in genuine honours to wish to retain, for an instant, one that is not their due."

COUNT DE VAL MARINO'S PATENT MODE OF GAS MAKING.

An experiment upon a new mode of gas making by the Count de Val Varino was made on Thursday evening (12th inst.) on a piece of waste ground at the back of Fetter-lane, in the presence of several scientific gentlemen, who were invited to witness the result. A small gasometer was erected for the purpose, which was connected by tubes with a furnace built of brick, and containing three retorts, one of which was supplied with water from a siphon, another was filled with tar, and both being decomposed in the third retort, formed the sole materials by which the gas was produced. The process appeared to be extremely simple, and the novelty of the experiment consisted in the fact, that the principal agent employed to produce the gas was common water combined with tar; but according to the theory of the inventor of this new species of gas, any sort of bituminous or fatty matter would answer the purpose equally as well as pitch or tar. After the lapse of about half an hour employed in the experiment, during which time the process was explained to the company, the gas was turned into the burners, and a pure and powerful light was produced, perfectly free from smoke or any unpleasant smell. The purity and intenseness of the flame were tested in a very satisfactory manner, and those who witnessed the experiment appeared perfectly satisfied with the result. The great advantage of this sort of gas over that produced from coal consists, it was said, in the cheapness of the materials employed in its production, the facility with which it is manufactured, and the perfection to which it is at once brought *without the necessity of its undergoing the tedious and expensive* process of condensation and purification; for in this instance, as soon as the preliminaries were completed, the light was produced in a perfect state within a few feet of the gasometer, which, although of inferior size, was said to be capable of affording light for 10 hours to at least 500 lamps or burners. With regard to the comparative expense, it was also stated that 1,000 cubic feet of gas manufactured by this process could be supplied to the public for about one-third the price now charged by the coal-gas companies; and it was said to be equally available for domestic use, and more safe than the common gas, inasmuch as small gasometers might at a trifling expense be fixed at the back of grates in private dwellings, from which the gas could be conveyed in India-rubber bags to any part of the house, thereby preventing the many accidents which occur by the use of tubes and pipes. The Count de Val Marino, who has conquered the difficulty hitherto experienced in bringing this species of gas into use, superintended the arrangements, and evinced a natural anxiety to bring his experiment to a successful issue. He has taken out a patent for his discovery, and he has improved upon the burners now in use, so as to render the light produced more pure and intense. For this improvement he has also secured a patent, How far gas of this description can be brought into general use, or whether in point of economy the public would be benefitted by its adoption, are questions which we have not the means of deciding, and, without hazarding any opinion on the subject, we can only say that the experiment, as far as it was tried in this instance, appeared to be quite successful.—*Times.*

SPENCER'S PROCESS OF COPYING MEDALS ETC. BY GALVANISM.

Considerable interest has been excited in the scientific world by Mr. Spencer's new process of copying medals and other works of art, in copper, by the agency of voltaic electricity (see *ante*, p. 54). It is with great pleasure we hear that this process is already beginning to be employed in certain of our manufactures, and that thus electricity will soon be numbered amongst the agents employed for practical and useful purposes. In our former account of Mr. Spencer's invention we spoke highly of the merit of the discovery and the probable uses to which it might be applied: the result has borne out our anticipations. In the manufacture of plated articles and ornaments, it is often desirable to copy ornamental work, such as leaves, flowers, and arabesque mouldings; this is both difficult and expensive, and from these causes

often impossible. Mr. Spencer's invention, however, affords a cheap and easy method of performing what is required, and thus, ornaments on rich ancient plate are copied with the greatest perfection and ease, and without injury to the original. The great advantage consisting in the means of obtaining, at very small expense, a fac-simile in copper, of the ornaments required to be copied, which may then be silvered or gilt. In another art, the voltaic process is, we are informed, being successfully introduced. The makers of buttons often require to have two or three of a particular pattern to complete a set of which they have not the die. To take a cast from the button is, for many reasons, inconvenient and objectionable; and the voltaic process, at the cost of a few hours and very little labour or expense, furnishes a perfect fac-simile of the button, which then only requires to be gilt. It has been said that there is a difficulty in obtaining perfect copies, and that the deposited copper is brittle, porous, and full of holes, but whoever will read attentively the process of Mr. Spencer and follow it, must succeed. The casts of medals, transmitted to us by Mr. Spencer, and also those made by Mr. E. Solly and Mr. J. Newman, and exhibited lately at the meeting of the Society of Arts, were very pure and compact copper, and the surface was as brilliant and perfect as could be desired. The process, indeed, is simple, and so far from its requiring, as is generally supposed, either expensive and complicated apparatus, or deep scientific knowledge, nothing can be more easy, as the observance of a few rules renders the success of the process quite certain, and, as regards the expense of the apparatus, the whole of it may be easily procured for a few pence.—*Athenæum.*

ON STEAM BOILER EXPLOSIONS.

Mr. J. Sims, of Chacewater, lately delivered a valuable lecture to the members of the Truro Institution, on Heat and its effects. The former part of the lecture was devoted to a consideration of the various powers of this chemical agent, and many interesting facts were communicated respecting its wonderful operations. The lecturer afterwards proceeded to speak of steam-boiler explosions, and as Mr. Sims is an engineer of much experience and of established reputation, we have much pleasure in communicating his opinions to the world, as the subject is one of the deepest interest, and cannot be too frequently canvassed:—

I beg to call your attention to a few *brief remarks* on steam-boiler explosions, *which I have been led to* make in consequence of the many distressing accidents that have occurred in this county during the last few years, and which I am sorry to say have been lamentably destructive of human life. I more particularly refer to the Cornish engines than any others, because we, in Cornwall, work with steam which is generally termed high-pressure, that is varying from about 10lbs. per square inch to 50lbs. per square inch, and this in proportion to the load of engine and the opinion of the engineer in point of economy of fuel. In making these remarks I have called to my aid the opinions of some of our most eminent engineers in conjunction with a long and extensive practice of my own, and taking into the account the very great increase of steam-engines out of Cornwall, exactly on the plan now in general use in this county, it calls loudly on all who are or may be employed in the construction of steam-engines, more especially in that part of it which is termed the boiler or steam generator, to so modify the thing as to render them as safe as possible, and to make use of steam, which would be much more safe in its operation, and equally beneficial, so far as regards economy of fuel. The form of boilers now in use in Cornwall are cylindrical, having a cylindrical tube; the general size is about 6ft. 6in. diameter, with tube varying from about 3ft. 9in. to 4ft. diameter; about six feet long of this tube is used as the furnace or fire-place, consequently the whole of the fire is surrounded by water. Various opinions have been suggested of the causes of explosions, some attributing them to the igniting of explosive gases generated within the boilers themselves, but I think this opinion is not based upon any satisfactory or valid foundation. Under certain circumstances hydrogen gas may be formed inside a boiler, in consequence of the over-heated iron plates decomposing the water of the steam by abstracting and uniting with its oxygen; but the circumstances under which this process may go on, I conceive must be exceedingly rare, and the effect of very trifling amount. If it were possible for the gas to be formed in any considerable quantity the circumstance must be immediately known by the very perceptible effect it would have upon the working of the engine; or how, I would ask, is the gas to become of greater pressure than the steam, even if the engine should not be at work when there is the same aperture for its escape. There is one fact of so strong and irrefragible a character, that in my opinion it decides the fate of this hypothesis, and clearly proves that steam-boiler accidents cannot be attributed to the explosion of gases. The fact alluded to is this, that an explosion or a collapsing in the nu-

merous class of low-pressure boilers are things never heard of, while they are too numerous among high-pressure boilers, although it is certain that the low-pressure boilers are quite as likely to form the gases as the latter. The plates of the fire-places and flues of low-pressure boilers are quite as likely to form the gases as the plates and flues of high-pressure boilers, because the low-pressure boilers are probably quite as much exposed to the mischance of becoming red hot, and from their great capacity are likely to hold the gases in greater abundance; but notwithstanding, in low-pressure boilers no explosions do take place, no fatal accidents, no loss of life. I think in doing away with the opinion respecting gases, the causes of steam-boiler explosions may be classed as follows:—1st. In the improper form of the boiler being insufficient to bear the pressure of steam which the engineer may think proper to use.—2d. In the neglect of the engine man allowing the water to get below the back of the tube, which is the back of the fire-place, thereby allowing that part to be heated to a very high temperature, and of course rendering the iron weak and less capable of bearing the pressure of steam, and which is in proportion to that temperature.—3d. By being weakened by wear and not proper attention paid to lessen the the pressure of steam in proportion to that wear. But I fear the greater number have exploded by means of using steam of an unnecessary pressure; and in order to render this fact as clear as possible, I beg to remark here that the Cornish engineers, in carrying out the great principle of working steam expansively, and which principle has been the means of causing the Cornish engines to exceed all others in point of economy of fuel, I say they have (myself amongst them) lost sight of one important feature in this principle of expansion, which is that of omitting to have the apertures for the admission of steam from the boilers to the steam cylinder of a proper size, or of a size large enough for the proper admission of the steam in proportion to the load of engine and pressure of steam required. The consequence is, that it is found necessary to have steam in the boiler of a much higher pressure than would be necessary, provided the aperture from the boilers to the cylinder had been a proper size—and this is in a ratio proportionate to the load of engine and rate of expansion. This important feature in the steam-engine has been so far neglected, that I have known a 7-inch aperture only used for the admission of steam on a 70-inch piston. The area of the *70-inch piston being upwards of 100 times as much as the area of aperture or valve for* the admission of steam, it becomes a natural inference that so small an aperture could not possibly supply one-third of such large cylinder in about a second. I mention one-third of the cylinder, because that is about the average distance which the pistons do descend before the steam from the boiler is cut off, the remaining part of the stroke being performed by the expansibility of the steam which entered the cylinder for that one-third of stroke. The consequence of having such small apertures is, that it is found necessary to have steam in the boilers of a pressure very much above what would be necessary, provided the steam-pipes and steam-valve had been of a proper size; and this inconvenience becoming more as the load of engine increases, I fear that explosions of the worst character have taken place in consequence.

I have reason to believe that the present cylindrical boilers in use in this county are as safe with 30lbs. per inch pressure as the old low-pressure boilers were for the steam they used—and in all the steam-engines of which I have the management I have made it a rule for some years that I would use steam of no high pressure; since which I have had no explosion nor anything in the shape of a serious accident. The average duty of the engines has been above what it was before, and the boilers will last a considerable time longer. Respecting the lamentable explosion which took place at the Consolidated Mines a short time back, the distressing effacts of which must still be fresh in your memories, it was stated that it must have been caused by the neglect of the engine man in allowing the water to get below the back of the tube; and the reason assigned for this was, because that boiler was said to be the strongest, and must have been weakened by heat to cause it to explode; and the other two boilers, which it was said were not so strong, remained uninjured. The strength of cylindrical boiler tubes to resist an external pressure, exerted on its outward surfece, is a very different thing from the strength of the same tube, to resist on internal pressure, because when the force is exerted on the inside of the tube and tending to burst or rend it asunder, the relative strength or power of the tube is very easily estimated. But in the other case, when the pressure is external, the strength of the tube to resist such pressure will depend upon very different principles. The tube in this case depends for its strength on the perfect state of the circle of which it is formed, and the thickness of the plates; and it must be clear that steam of from 40lbs. to 50lbs. per square inch, acting on an arch of about four feet span, made of half plate, will cause that

arch which is most imperfect to collapse first; and that if a tube has got any defect as to form, so as to render it a more imperfect arch than the next boiler alongside of it, it will yield to the pressure before the other, although in appearance it was the strongest boiler; and further, the one with the imperfection is weakest, in proportion to the amount of the imperfection, and the liability to explode becomes more, in proportion to the increased temperature and pressure of steam, thereby rendering the plate weaker through heat, and consequently less capable of resisting the increased pressure; and really if we look at an arch of four feet span only, made of iron-plate of half an inch thick, considerably weakened by heat, and with a force of 50 lbs. per square inch acting on them, and unavoidably imperfect as to form, it becomes a matter of very little surprise to find they will collapse; under all these circumstances it appears to be too much to say of boilers having just the same appearance which is the strongest. If it were possible to form a tube of a boiler of a perfect circle, which would be the true figure of greatest resistance, there is little chance of its remaining so: the expansion and contraction, together with the increased pressure against the bottom of the tube in proportion to the height of water in the boiler, which gives upwards of 3 lbs. per inch pressure more there than in the top of the tube, has a strong tendency to injure its circular form. The imperfect form of tubes to support an internal pressure is not off so much consequence, because the pressure tends to improve the form; but with an external pressure the contrary effect takes place. The extraordinary effects which often take place by means of boiler explosions, I consider are in proportion to the quantity of fire in the furnace or tube, and quantity of water in the boiler, and by means of the tube collapsing and the water bursting immediately into the fire, generates steam of an incalculable pressure, the sad effects of which I need not mention here. Various plans have been suggested in order to prevent explosions, some by giving a signal to the engine man when the water is got too low in the boiler; but a question arises, whether or not the occasional defective state of these things, together with the reliance or dependence the engine man would place in them, would not be the cause of more explosions in a given time than there has been without them. The common gauge cocks are sure indicators of the state of the water in the boiler, and if the engine man neglects these things I would *not place much reliance* on the safety of any *other thing*. *Lead plugs* have been applied *immediately over the fire*, the intention of which has been that if the engine man should allow the water to get below the back of the fire-place, the lead should melt and thereby give the engine man notice of danger; but this can be of little or no use, because it requires a temperature of 610 degrees to melt the lead, which temperature will cause the iron to become so weak, that steam of ordinary pressure will at least injure the boilers before it has attained the above heat. The present cylindrical boilers now in use in this county, and in many other parts, are, in my opinion, the most economical generators of steam, and the most safe that have been hitherto adopted; but it must be borne in mind that no boiler, of whatever form, can be safe without proper attention being paid by the engine men as to the water gauge, and by the engineers as to the pressure of steam used in proportion to the strength of boilers. And I would beg strongly to recommend that with the strength of boilers at present in use in this county, steam of more than 35 lbs. per square inch should not be used; and that proper apertures for the admission of steam on the piston, in proportion or suitable to that pressure, should in all cases be used. I am fully satisfied that if this is properly attended to we shall have no more violent explosions.—*West Briton.*

SECRETARYSHIP OF THE SOCIETY OF ARTS.

An extraordinary general meeting for the Election of a Secretary to this Society, in the room of Mr. Aiken, was held on Wednesday last, the 18th instant, at 11 o'clock, at the Adelphi; Joseph Hume, Esq., M.P., in the chair. The *Government* candidate was successful—the choice of the Society falling upon Mr. W. A. Graham, by a majority of two votes over Mr. Williams. The number of members who voted for Mr. Graham was 96, and for Mr. Williams 94;—the other candidates, in sporting sphrase, were "nowhere"—some had not a single vote. For the office of a General Secretary, Mr. Graham is certainly tolerably well qualified, but for the peculiar duties to be discharged by the officer upon whom, we may almost say the *management* of this Society rests, we think he cannot show, at least he has not shown, any pretensions. By dint of private friendship and personal influence in the upper circles, where Mr. Graham has been employed as tutor (and to his ability in which capacity nearly all his testimonials applied) and under the auspices of the first Lord of the Admiralty, he has obtained the Secretaryship; while the candidate who was supported by the whole body of those who take an active interest in the affairs of the institution, and to whom the other candidates with scientific

pretensions gave place, was, as we have stated, left in a minority of *two*. It is not to be expected that Mr. Graham can work well with these members.

The prosperity of the Society hinged upon the result of this election; all hopes, therefore, of its renovation and extension are now, we fear, at an end. Out of more than a thousand members, only little more than two hundred could be got to vote upon the occasion, and many of those who did so came to the society for the first time in their lives. The principal ground of fitness set up by Mr. Graham, was his knowledge of languages, which certainly to us seems a poor substitute for a practical and intimate acquaintance with "Arts, Manufactures, and Commerce," for the encouragement of which the Society was founded, and of none of which did he pretend to have more than that smattering knowledge which is necessary in a modern general education. The idea of many of the members with whom we conversed seemed to be, that a Secretary was wanted who would canvass for new members, and talk to and amuse foreigners who might visit the Society, and that for these duties they considered Mr. Graham well fitted, from his gentlemanly address and winning manners! An increase of members is certainly a desirable object, but this should result from public appreciation of the Society's usefulness, and not from compulsory recruitings from the highways. No other "prosperity" can be permanent.

All the proceedings arising out of the resignation of Mr. Aiken were conducted, if not in an unfair, certainly in an unbusiness-like and blundering, way. The information of the vacancy was only conveyed to many of the members by the circulars of Mr. Graham and Mr. Williams. Some of the candidates who had been called forth by the *recent* advertisements animadverted in no measured terms upon the conduct of the Society—the first public official notice of the vacancy appearing in *November*, whilst two of the candidates were in the field early in *June*.

Mr. Hume, in addressing the Secretary elect, told him that properly to fulfil the duties that had devolved upon him, he had a most arduous task to perform, which was rendered the more difficult by his being the successor of one who had so well and honourably discharged it. For the good of the Society we say—may he disappoint our fears!

NEW COMET.

At the Royal Astronomical Society, last *week, a new comet was announced to have been discovered in the constellation* Virgo by *M. Galle, assistant* at the Berlin Observatory, on the morning of the 3d of December, 1839, on which day the observations were as follow:—

Berlin.

Sidereal Time.			Right Ascension.		
h.	m.	s.	h.	m.	s.
11	1	14	12	38	25
11	9	42	12	38	28
11	21	45	12	38	32
11	40	39	12	38	40

Daily variation, $+ 2^\circ 12'$; declination, $+ 0^\circ 19'$

In the year 1831 the King of Denmark had caused a gold medal to be cast, to be given to the first discover of a comet not visible to the naked eye; and it is somewhat singular that this discovery took place only three hours previously to the King's death.

NOTES AND NOTICES.

Steam at the Antipodes.—A "British and Australasian Steam Navigation Company" has been set on foot at Sydney, with a capital of no less than half a million, in order to extend the benefits of communication by steam with the mother-country to that flourishing country, through the medium of a connexion with the "India Steam Ship Company," which, it may be remembered, intends to establish a line of packets by the Cape of Good Hope route. From this it would seem that the confident assertions before the House of Commons Committee, a year or two ago, to the effect that the Australians had the steamers necessary to complete the line from India to their territory *already built and fitted*, were (as more than suspected at the time) mere matter of moon-shine.

Mr. Cockerill's agreement with the Emperor of Russia.—Advices from Liege state, that Mr. John Cockerill has set out for St. Petersburg, taking with him one of the principal persons employed at his works, and three engineers. The Emperor Nicholas, it is added, has advanced to Mr. Cockerill 10,000,000 francs at 5 per cent. secured on all his establishments in Belgium, Russia engaging to purchase annually to a certain amount machinery to be manufactured in them, which is to diminish annually, as the Emperor, assisted by Mr. Cockerill, shall have created similar establishments in his own dominions.

Self-acting Tools.—It is by means of these admirable adaptions of human skill and intelligence that we are giving to the present age its peculiar and wonderful characteristic, namely, the triumph of mind over matter. By whom or when the *slide* principle was first introduced we need not now enquire; suffice it to say that, by means of this principle, a most wonderful substitute has been found for the human hand in the fabrication of almost all parts of mechanism, whether the substance to be operated upon weighs tons or grains. The slide principle is that which enables a child, *or the machine itself*, to operate on masses of metal, and to cut shavings off iron, as if it was deprived of all hardness, and so mathematically correct that even Euclid himself might be the workman! It is by the slide principle that we are enabled to fix a steel cutter into an iron hand, and constrain or cause it to move or slide along the surface of a piece of metal in any required direction, and with the utmost precision. By means of this principle all the practical difficulties hitherto encountered in the extending and improving of machinery generally, were, at one blow, cleared away. By its means the formation of every geometrical figure became a matter of the greatest ease, and a principle of absolute and unerring exactness took the place of manual dexterity. The impulse given by the slide principle to the manufactures of this country, in the construction of machines for forming other machines, ca

scarcely be imagined. On the application of an unerring principle to *machine-making machinery*—which *tools* may be defined to be—the mechanical energy of Great Britain, sprang forward at once to that supreme station which she now maintains, and which, if her artisans keep pace with the times, she will ever retain."—"*Manchester as it is.*"

Herapath and Cox's Patent Leather.—I should feel obliged by the insertion in the *Mechanics' Magazine* of a few remarks on Herapath and Cox's patent for tanning. I have been working several months under their license, and can speak confidently of the advantages of their system from actual experience. The quality of the leather is decidedly improved by this process; it is much more solid and at the same time flexible, consequently more durable and impervious to wet than any other leather that I am acquainted with. As regards the advantage to the tanner, there is a saving in labour, an increase of weight amounting to several pounds per hide in sole leather, varying of course with the quality of the hide, a saving in time of from three-fourths to five-sixths of the time required by the ordinary method. This saving of interest, rent, and other charges, is alone a sufficient recommendation to any one acquainted with the old process. To any one interested in the subject I shall be glad to furnish further particulars.—I am, respectfully, Henry Binns. Liverpool, 12th mo. 16th, 1839.

[A few butts have been sent to our office, which our publisher will be happy to show any one desirous of examining them.—Ed. M. M.]

Boiled Bone Dust Manure.—The effects produced from bone dust, in the cultivation of the soil, are really astonishing. A gentleman who used the dust of boiled bones on a very dry soil, declares that its effects were visible three weeks afterwards. Boiled bones are but half the price of other bones, while they come much sooner into operation; and a friend had assured him that a field which he had dusted five years ago with boiled bones, was now quite as good as in the first year.—*Anglo-Germanic Advertiser*, as quoted into the *Aberdeen Journal*.

Borrie's Patent Furnace.—On Saturday, the 7th inst., a new iron steamer *Enterprise*, built and fitted out by Mr. Borrie, of the Tay Foundry, started on a trial trip to Newburgh. A striking feature in the *Enterprise* is the consumption of smoke. This is effected by a plain and very simple contrivance in the interior of the furnace. The furnace bars instead of being straight are curved on the upper surface, and are so adjusted in the furnaces as to form a very acute angle with the front of the boiler at the furnace doors, whilst towards the posterior extremities they are horizontal, in other respects they are similar to those in general use. The furnace covers deflect about 18 inches into the furnace, within two feet of the inner end, which forms a water chamber. The distance between the upper surface of the coals, when the furnaces are fully charged, and the under surface of the deflector is about six inches. The coals for every new feed being deposited in the anterior part of the furnace, which is fully two-thirds longer than the posterior part or space behind the deflector, it follows that the coals before requiring to be pushed back into the space behind the deflector must have become very highly ignited and the component parts which cause the emission of smoke entirely disappear. Then the posterior fire chamber being always charged with fuel which only admits a pure and intense flame. the smoke arising from the coals in the anterior chamber having to pass underneath the deflector or come immediately into contact with the flame in the posterior chamber, and having to pass through in its way to the flues is exposed to its most intense action, whereby it is immediately consumed. The arrangement in this instance has proved completely successful; smoke could only be seen for the space of three or four minutes, when the stokers were renewing their fires. This is the first instance in which the above-described mode of consuming the smoke has been applied to the boilers of steam-boats. A twenty-horse power land-boiler, with a furnace similarly constructed, was made by Mr. Borrie about six months ago, of which we took notice at the time. Since it has been in use we have had frequent opportunities of witnessing its performance, and the absence of the dense cloud of smoke at the chimney top is the best evidence of its efficiency. The distinguishing feature of this plan is, that the smoke is actually burned, and that by the most simple apparatus, while in other patents professedly brought before the public for effecting the same purpose, the smoke is not consumed, but lodges itself in the form of soot behind the furnace dykes, flues, and bottom of the chimney. This occurs when a discharge of steam is admitted into the furnace. The particles of smoke thereby acquire additional gravitation, and consequently effect a lodgment as above described—the ascending volume of air not being sufficiently buoyant to carry them out at the chimney top.—*Dundee Chronicle.*

Planing Iron.—Sir,—I have long had an idea that the strong iron bed of a turning lathe might be made so as to be occasionally used for the purpose of planing iron, and as I am about to have a new one cast—could any one of your ingenious correspondents point out the best mode of arranging the model, or give a drawing of the same? They would confer a lasting obligation on one who is far removed from the convenience of having his work planed. I cannot conclude without offering many thanks to your intelligent correspondent, Mr. W. Baddeley, for his excellent mode of case-hardening iron. I remain, &c., I. Sicnarf. Dec. 14, 1839.

Espy's Theory of Rain Anticipated.—Sir,—Whatever may be the merits of the Theory of Rain described in the *Mechanics' Magazine* for July last, No. 832, page 286, and although it may be quite new to Mr. Espy, Professor Bache, and other equally learned Americans, it is certainly not so great a novelty on this side of the Atlantic; since the very same thing has been particularly described more than 10 years ago, in the *Quarterly Journal of Science* for April, 1829, page 68, and again, in the Article Hygrometry, of the *Encyclopædia Britannica*, vol. xii, page 132.—*Suum Cuique.*

Miller's Letter Balance.—Under the new postage law every person who has much correspondence will require a machine to weigh his letters. We have seen, in Mr. R. A. Miller's office, a very neat and convenient contrivance for this purpose. It is an elegant application of a philosophical principle, uniting beauty with simplicity, accuracy and expedition. The weight is exhibited by the descent of a small ivory cylinder in a glass tube, a little wider than its diameter, and filled with mercury; a slender stem, passing through an ivory case, supports a thin plate of horn, on which the letter is laid; and rings marked on the cylinder, measuring the descent, indicates whether the letter weighs half-an-ounce, an ounce, or more. The operation is performed in an instant.—*Dundee Chronicle.*

Perfection of Steam.—Jonathan says—"To such a perfection they have got steam in Kentucky, that a grocer there has discharged all his shopmen, and actually has two engines to serve in their places. A cunning thief observing this, thought it a good opportunity to help himself. He accordingly went in, secured a loaf of sugar, and was about to make off; but it was 'no go,' for one of the engines collared him, gave him in charge, and when I left the office (continues Jonathan) the engine was about to give its evidence."

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Sheet Missing 209

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Fig. 3.

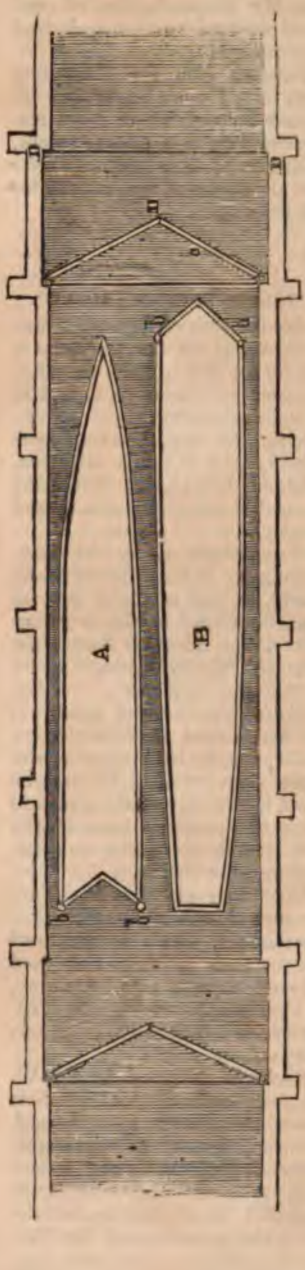


Fig. 4.

Three canal barges have already been built upon Mr. Watson's plan of construction, of 60 tons burthen each, and with eminent success.

Mr. Watson's plan for shortening canal boats is of more importance in Scotland and Ireland, where canal travelling is carried on to a greater extent, than is England; here railways bear the palm as the means of transit both for goods and passengers.

THE "CYCLOPS" STEAM FRIGATE.

On Friday the 13th of December inst. this splendid vessel left her moorings at Blackwall, for a trial trip down the river, and to proceed to Sheerness to take in her guns and equipment.

This being the largest steam frigate in the world, excited much attention, and throughout her passage down the river was an object of great curiosity and admiration.

The trial was made under the directions of the Lords of the Admiralty and their officers, several of whom were on board, viz., Sir C. Adam, the Secretary of the Navy, Mr. More O'Ferrall, Sir E. Parry, Sir W. Symonds, Captain Nott, Captain Austin, &c. &c.

Her performance was most excellent; the speed was found to be about ten knots or eleven and a half miles in still water, her engines working twenty-one trokes; and it was universally remarked that there was an entire absence of the unpleasant tremulous motion so generally found in other steamers.

After proceeding close to the Nore light, she turned and met the *Fearless* Admiralty steamer, which accompanied her down, and their lordships embarked in that vessel to return to Woolwich, while the *Cyclops* proceeded up the Medway and made fast to the buoy off Sheerness dock-yard.

This vessel was designed by Sir W. Symonds, and built under his immediate superintendance at Pembroke dock-yard. She combines in a most eminent degree the qualities of both sailing and steaming, together with such improvements as have suggested themselves to her designer from the experience of the *Gorgon.*

She is propelled by two engines of 160 *horse power each,* made by Messrs. J. and S. Seaward and Capel, on the new principle adopted by them, by which they dispense with the large cast iron side frames and sway beams, the cross heads, side rods, &c. &c., and thus bring the weights of these engines to 70 tons less than they would have been, had they been made on the common beam principle, and thereby also effect a very important saving of space in the length of the engine room.

These engines are fitted with Mr. John Seaward's patent mode of warming the feed water on its passage to the boiler, by causing it to pass through a number of copper pipes, around which the spent steam from the cylinders circulates on its way to the condensers, by which means the heat of the feed water is elevated about 60 degrees above the usual temperature, and a saving is thereby effected in the consumption of fuel of 7 per cent.

There are four copper boilers for supplying the engines with steam, made entirely of copper, and placed in pairs, back to back, with a fore and aft stoke hole; these boilers are clothed on the system first used by Messrs. Seaward, and since introduced into the navy for her Majesty's steam ships for the prevention of the radiation of heat, the advantages of which were evident in the surprising coolness of the engine room. A barometer placed against the side of the boilers only rose to 68 degrees, and another in the stoke hole to only 72 degrees. The boilers are fitted with Mr. J. Seaward's patent apparatus for detecting and indicating the state of saltness of the water in the boiler, and with a receiver and apparatus for blowing out, when the time for that operation has arrived, by means of which all danger from salting the boiler or blowing out the water too low is entirely obviated, and the boiler may be worked as long with salt water as with fresh.

There are coal boxes placed on each side of the vessel the whole length of the engine room, and holding when full about 450 tons of coals.

Her consumption of fuel by actual weight (the coals being weighed during the trial, was 17 cwt. per hour, equal to 6 lbs. of coal per horse per hour.

The *Cyclops* is commissioned by Post Captain Austin, late of the *Medea;* she is the only steam vessel in the navy, besides the Gorgon, of the rank of frigate

Her engine room crew will consist of four engineers, twelve stokers, and four coal trimmers.

The total number of hands, including officers and a lieutenant's party of marines, will be about 210 men.

Her dimensions are as follows:—

	Ft.	In.
Extreme length	217	9
Length of upper deck	195	2
Width across paddle boxes	57	0
Length of engine room	62	0
Width of beam	38	0
Depth of hold	23	0
Engines.		
Diameter of cylinder	0	64
Length of stroke	5	6
Diameter of paddle-wheel	26	0
Width of wheel	8	0
Weight of engines, boilers, and water	280 tons	
Weight of coals for 25 days' consumption	450 tons	
Draught of water with all her guns, ammunition, engines, coals, and stores, for six months	16f 6in.	
Tonnage	1200 tons	
Power of engines	320 horses	

The armament of the *Cyclops* will consist of—

On the Upper Deck.

Two 98-pounders—one at the stem and the other at the stern.

Four 48-pounders.

On the Gun Deck.

Sixteen 32 long pounders.

LIFE AND LABOURS OF TELFORD.

NO. 1.*

His Education and early Progress.

Thomas Telford, in common with the great majority of his predecessors in the highest walks of the profession of which he was so long the most distinguished ornament, owed nothing to the advantages of birth and situation. He was born of parents in the lower ranks of life, in the parish of Westerkirk, in the county of Dumfries not far from the English border, on the 9th of August, 1757. His father was a common shepherd in that pastoral and thinly-populated district, and died when his only son, Thomas, was but a few months old, leaving the care of his infancy and growing years to his mother, Janet Jackson, who survived long enough to witness the commencement of the brilliant career of her child. She died in 1794, enjoying to the last the dutiful regard and strong affection of her son, who is said to have always written his letters to her in printed characters, that she might be enabled to read them herself without the assistance or interference of others.

Telford received the rudiments of education at one of those establishments which do so much honour to Scotland, and have laid the foundation of fame and fortune to so many of her sons, her parish schools. That of Westerkirk, at this period, numbered among its scholars two youths, who were afterwards destined to serve their country in the high station of Ambassador and Admiral,—Sir John and Sir Pulteney Malcolm; and the other two knights who sprang from the same illustrious peasant-family were soon afterwards indebted for their learning to the same source; so that, undistinguished as it may be in literary annals, the place where Telford received his education may boast as distinguished names among its sons, and that in a few years only, as many prouder and richer seminaries whose records extend to centuries.

Young Telford could only be spared to the school in winter: in summer he was called to assist his uncle in the capacity of shepherd-boy, an occupation in which, much bodily labour not being required, he had leisure to turn the few books he could beg or borrow from his neighbours to good account; indeed it was at this time that he acquired an inveterate love of reading, which he indulged in throughout his whole life, whenever the pressure of business, generally very great, would at all permit him to follow the bent of his inclination.

It is singular enough, looking to his future career, that Telford's first claims to distinction should have been gained in the service of the muses; but it is not more strange than true. In his youthful days he became a liberal contributor to the poetical columns of the *Edinburgh Magazine*, under the *real* signature of "Eskdale Tam;" nor did he cease to cultivate his metrical talent for some time after he had acquired distinction in another walk. His epistle to Burns on his "Cotter's Saturday Night" was

* Under this head it is proposed to furnish a connected detail of the principal incidents, personal and professional, in the *career of the great Engineer, the materials drawn principally from his own autobiography, with additions from a variety of sources.*

dated from Shrewsbury, long after he had left the scenes of his early years, and it was while he resided at the same place that, at the request of his friends, he reprinted the most considerable of his productions,—the poem of "Eskdale," with the additions and retouchings which his more mature taste enabled him to give it. At the time of the French Revolution he was also for a short period a fisher in the troubled waters of politics; but both politics and poetry (the former most decidedly) appear to have been totally abandoned as he advanced in his career.

Though fond of "building the lofty ryhme," Telford was by no means idle in other repects. His early days were spent in employment as a mason around the place of his birth, a mountainous tract, where the operations of masonry consist chiefly in building dwelling-houses for the farmers, with the necessary appendages for agricultural purposes. Wherever, also, regular roads were substituted for the old horse-tracks, and wheel-carriages were introduced, numerous small bridges were required to be built over the mountain-streams; and, insignificant as these were, they furnished him considerable employment as a practical mason, and at the same time, afforded him thus early experience in the essential considerations and practical details of works of the kind. Indeed, to the experience thus humbly acquired, Telford himself confidently ascribed the groundwork of his great qualifications as an engineer,—and he even held it as matter of congratulation that his early circumstances had compelled him to begin by working with his own hands, being firmly of opinion, that by this means, he had enjoyed advantages superior to any within the reach of those who are enabled to take rank at once, in the higher grades of the profession. It was peculiarly fortunate for him that just at this period Henry, Duke of Buccleuch, to whom the whole of the surrounding country belonged, had entered upon a course of improvement on his estates, one of the chief features of which was a complete re-modelling and re-building of the farm residences and offices of his tenantry; so that an opportunity was thus afforded to the workmen employed of gaining a thorough insight into evey branch of the art and mystery of masonry; an opportunity which Telford did not fail to turn to the best account.

At the age of twenty-three, Telford considered himself completely master of his art, so far as it was practised in the country, and repaired in search of further improvement, to Edinburgh. Here was presented a very extensive field of observation, both in the old town, which abounded in curious and interesting specimens of the architecture of "auld lang syne;" and in that new town which had then just commenced to stretch its arms towards the north, and which has now entirely changed the aspect of the Scottish capital,—or rather added a second and most splendid city to that which formerly existed. Here there was of course much for Telford to study and to admire: during his stay he added much to his his stock of information, and seized the opportunity of joining to his other acquisitions that of architectural drawing, which in Dumfriesshire had been quite beyond his reach. After a residence of two years in Edinburgh, he once again determined to push forward, and "like many others of his countrymen," turning his face towards the south, resolved to seek his fortune in the great metropolis itself.

Telford arrived in London in 1782, and obtained employment on the quadrangle of the new buildings at Somerset House, then erecting under the superintendence of Sir William Chambers. To this celebrated architectTelford obtained an introduction, as well as to Mr. Adam, the designer of the Adelphi, and beyond all question the greatest architectural improver of the metropolis previous to the present century. The former of these appealed to Telford, both in his conversation and his productions,—the latter quite the reverse. He endeavoured, nevertheless, to profit by his intercourse with both, but soon came to the sound conclusion that his wisest plan was to depend on his own merits and exertions alone for his success.

After a short sojourn in London, Telford proceeded to Portsmouth, where he had been engaged to superintend the erection of a house for the commissioners of the Royal Dock-yard, from the design of Mr. Samuel Wyatt, who was also the contractor for the building. As this house was of considerable pretensions, being intended occasionally as a

residence for the king, on his visits to Portsmouth, it was a work of some importance. Upon this, and a new chapel in the dock-yard, Telford was occupied for a period of three years, during which his gain in experience was very great,—and experience, also, well calculated to qualify him for his future labours as an engineer. In a large naval arsenal like Portsmouth, operations in the erection of wharf-walls, the formation of graving-docks, and similar works, were continually going on, of all these Telford was no indifferent or inattentive observer, and it may safely be concluded that his engineering education, begun as a working mason among the braes of Eskdale, was carried far towards completion by the acquirements he made in a rank no higher than that of "Clerk of the Works" at Portsmouth.

On the completion of these buildings, which took place in 1787, Telford was invited to take charge, in the character of architect, of the repairs which had been determined upon to fit the ancient castle of Shrewsbury for the residence of Sir William Pulteney, whose attention was probably turned towards Telford on account of his having come from the same district. Sir William had originally been one of the border Johnstones, of Westerhall, in Telford's native parish, and had assumed the name of Pulteney on his marriage with the heiress of that great and wealthy family. In his service Telford passed several years, with mutual satisfaction, except for a short space, in which the architect's extravagant admiration of the heroes of the French Revolution (an admiration which, like many others, he soon exchanged for a different feeling,) had nearly caused a permanent estrangement from his friend and patron. During this period, Telford, who was always a zealous antiquary, took an infinity of pains, and to very good purpose, to unveil some extensive remains of Roman antiquity which had been discovered by chance at Wroxeter, five miles from Shrewsbury, and acquired no small credit from his exposition of the danger in which the church of St. Chad was placed from the defective state of its columns,—an exposition which, however unpalatable to the parish authorities, was fully confirmed by the fall of the building when, *in opposition to his views*, it *was injudiciously attempted to patch it up with some merely trifling repairs.*

Shortly after this, Telford was employed by the county magistrates to act as surveyor of a new goal which had been determined upon, on the plan of the philanthropist Howard, and he executed his task so much to their satisfaction, that when the opportunity occurred, they appointed him permanently the County Surveyor, and thus opened a new and wider field for his exertions.

THE CALCULATOR, NO. 7,—CASK GAUGING.

The example which in my last paper I gave of an improvement in the slide rule applied to cask gauging, having excited the attention of the gentlemen of the Excise-office, and it being also alleged, that Hutton's formula gave too small a content, I have been induced to look closely into the subject.

Notwithstanding the various expression of the rules for finding the content of a cask, I find that they may all be brought into one general form, viz $\text{C} = \frac{1}{3r}\text{LB}^2\,(x + yq^2 + zq)$ wherein $r =$ 353·036, the cylindrical inches in a gallon, $q = \frac{\text{H}}{\text{B}}$, and y and z co-efficients, the sum of which together with x is always equal to 3. And in the values given to these three quantities, the real difference between the rules consists—

	x	y	z
1, Spheroidal form..	2	1	0
2, Parabolic spindular	1·6	0·6	0·8
Hutton's variety..	1·3	0·83	0·87
3, Parabolic conoidal	1·5	1·5	0
4, Conical	1·	1·	1·

In Hutton's variety, the co-efficients are derived from an assumed compound formation of a cask, the middle third being taken as of the 2nd variety with an equal portion on each side of the simple conical form. The idea is said to be taken from the method used by workmen in constructing casks; but there is little doubt that the division of the axis into equal thirds is purely arbitrary, and that if such supposition be found to give too small a gauge, we are at liberty to estimate the middle portion as greater than than one-third. In short, we may adopt any values we please for x, y and z (their sum remaining constant) that will give a content according best with the actual average of casks.

When Dr. Young employed himself in

this inquiry, he was furnished with the particulars of 21 casks,* whose dimensions had been carefully taken by an officer of customs and their capacities accurately determined by weight of water. If this list fairly represents the average of casks, the true practical rule lies between the 2nd variety and Hutton's: for I find that the values of $x\ y\ z$, which will best agree with the actual capacities of these 21 casks, are 1·4, 0·6, and 1·0 respectively. But the number of vessels used seems not sufficiently great to command confidence.

Any person whose dealings in this line are extensive, may easily obtain a rule of calculation, corresponding with the average of 50 or 100 casks which he may select as the foundation of his process. Find the value of q, and also of $\frac{3\,r\,\mathrm{C}}{\mathrm{L\,B}^2}$ for each cask separately. Then pursue the graphic method‡ for the delineation of a regular curve, using the latter values as ordinates, and the former as abscissas; the ordinates of the adjusted curve are afterwards to be analysed into the three terms which constitute the factor $(x + yq^2 + zq)$. These being obtained, the formula for graduating the line X upon a sliding rule, is,

$$\log.\left[\sqrt{\left(\frac{3\,r}{yg^2} - \frac{4y^2x - yz^2}{4y^3}\right)} - \frac{z}{2y}\right]$$

g being the gauge point whose position is to be laid down.† But if it be wished to construct a table, in order to compute readily by the pen, such table must consist of three parts.

Argument.	*Tabulated Values.*
1, Bung diameter, ..	$\frac{x + \frac{1}{2}z}{3\,r}\mathrm{B}^2$.
2, Head diameter, ..	$\frac{y + \frac{1}{2}z}{3r}\mathrm{H}^2$.
3, Diff. of the diameters,	$\frac{\frac{1}{2}z}{3r}(\mathrm{B}-\mathrm{H})^2$.

From the sum of the quantities furnished by parts 1 and 2, subtract the quantity given by part 3, multiply the remainder by the length, and the product is the content in gallons.

It will be an improvement to insert in part 3, the complements to unity; and then the quantities from all three parts of the table will be additive, and unity be taken from the sum.

J. W. Woollgar.

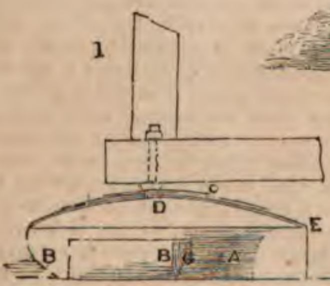
Lewes, Jan. 18, 1839.

GARDNER'S RAILWAY SNOW PLOUGH.

3

2

1



* The list is to be found in the *Journal of Science and Arts*, vol. 16. The values of q range from 0·723 to 0·864. Dr. Young's peculiar method is illustrated in *Mech. Mag.* vol. vii.

† *This formula is not so difficult of application as it would seem to be.* Mr. Rooker, of Little Queen-street, the maker of my "Pocket Calculators" has been furnished with the numbers from it, both according to the "Second Variety," and "Hutton's Variety."

‡ The same as is pursued for eliminating errors of observation in astronomy, vital statistics, &c.

Sir,—Having invented a method for clearing snow and other things off railways that might impede the travelling of the steam carriages, I hope the following description thereof may not be thought unworthy of publication in your useful Magazine.

I am, Sir, etc.

JOHN GARDNER.

3, Queen Elizabeth's Row, Greenwich Road, December 25, 1838.

Fig. 1 is a side view; fig. 2 a plan; fig. 3, a cross section. A are the sides of the plough composed of two thick pieces of sheet iron fixed together by rods on bolts; G is the scraper, at one end of the plough, about double the width of the rail; the other end of the plough is double the width of the scraper, by which means the snow is caught by the scraper G, and slides off at the sides, and a furrow is thus thrown up on each side of the rail, and the surface of the rail is left clear.

B are the slips rounded off for the purpose of going with more ease over those rails that rise one above the other. The plough is fixed to a spring at C, which is for the purpose of keeping it with sufficient pressure upon the rail. The whole is bolted to the frame of the engine or tender for the purpose of removing it from one train to another.

IMPROVEMENT IN THE CHUNK PATENT STOVE—DILUTED GAS STOVE, ETC.

Sir,—The near approach of "Old Father Christmas," and the possibility of "Jack Frost" being in his train, again resuscitates the "stove question." The season of "stove excitement," however, has passed away, and left us in a condition soberly and wisely to investigate the real merits of our old acquaintances, including the "nine days' wonder," and to receive with suitable circumspection all new candidates for public favour. The *anti-ventilating* class, generally, are at a discount; they are very properly giving way before the more congenial and salubrious varieties, in which the noxious products of combustion are removed by that *modern* contrivance—a chimney.

Of these, the present favourite is decidedly the chunk *patent stove* of Mr. *Prosser, a very full* and *interesting* description of which appeared in your 851st Number, page 146. This stove has several peculiarities, and all of them of an advantageous kind. Among these may be noticed the admirable mode in which the heat is radiated, which is not from the surface of the stove itself, but from a sort of mediator or conductor in the form of a containing vessel or casing, which receives the particles of caloric given off by the stove, as well as from the products of combustion. These being diffused over an extended surface become so moderated as to exercise no injurious influence on the atmosphere of the apartment, what is lost in intensity being amply compensated for by the increased extent of heating surface thus brought into action. In all the ordinary chimney stoves, the hottest particles of air, and of the gaseous products of combustion fly directly "up the flue," carrying off large and wasteful quantities of caloric. In Mr. Prosser's ingenious contrivance, the heated vapours are made to circulate within the jacket before alluded to, and as they become deprived of their caloric by contact with its surface, they gradually descend, the lowest of the series (the coldest) escaping by the pipe placed at the *bottom* of the stove for that purpose.

There is one purpose for which the chunk patent stove is admirably and especially adapted. Any person acquainted with the difficulty of maintaining *no more* than a healthy temperature in any workshop where there are a number of hands employed, with an *accessible stove*, will fully understand and appreciate what I am about to state. In such cases it is useless to interdict the men, or to attempt to reason with them on the impropriety of their conduct; they will, in spite of you, poke, and stir, and heap fuel on to the fire, till they become involved in a suffocating atmosphere. The chunk patent stove presents an effectual remedy for this evil, but it requires a trifling addition which I here take the liberty of pointing out. A short piece of strap iron having a hole at the end, should project horizontally from the jacket of the stove immediately over the stem of the regulating valve. This stem should be pierced lengthwise with a number of holes, so that one of them should always correspond with that in the piece projecting from the jacket,

whether the valve be wide open or nearly closed. The stove being charged with fuel, the valve is to be adjusted so as to regulate the rate of combustion and evolution of heat according to the requirements of the season. A padlock placed through the two holes that are in opposition will effectually prevent either the removal of the jacket, or the altering of the valve, leaving the powers of the stove entirely under the control of the foreman of the shop, or his deputy.

Among the "old friends with new faces," who are just now paying us the "compliments of the season," I may notice the *new* gas stove of Mr. E. Gilbert, civil engineer, of Falmouth, a description of which appears in this day's number, copied from the *Bath Chronicle*. There is in reality very little novelty in this contrivance. The very great advantage to be obtained from burning *diluted gas* in stoves, for culinary or domestic purposes, was fully demonstrated several years ago, by Sir John Robison, Secretary of the Royal Society of Edinburgh, and stoves constructed on this principle (*i. e.* diluted gas stoves) have long been sold by Mr. Ricketts, of Agar-street, Strand.

Gas stoves certainly afford *an easy*, and also a tolerably *efficient* means of warming, but neither their *wholesomeness* nor their *economy* have yet been, or seem likely to be, demonstrated.

I remain, Sir, yours respectfully,

WM. BADDELEY.

London, Dec. 21, 1839.

MR. HEATH'S NEW SOLAR SYSTEM.

Sir,—After giving most patient consideration to Mr. Heath's communication at page 183, not for the purpose of discovering its truth or falsehood, the latter being self-evident, but in order to understand what his meaning could possibly be, I confess that I am unable to unravel it. The first portion of his letter seems to mean, if it means any thing, that because the attraction of the moon in any one tide may raise a wave 10 feet high, it must in the next raise it 30 feet, and so on, there being no limit to the increase! I commend Mr. Heath's resolution, announced in his postscript, of not engaging in a controversy on the cause of the *precession of the equinoxes*. Even though he *understood the subject*, or rather even though he *understood the explanation of it*, which the lights of science have condescended to give for the benefit of the less gifted (but which Mr. H. evidently either never studied, or never comprehended), still it is of a nature too abstruse to be discussed in a general publication like the *Mechanics' Magazine*. I recommend Mr. Heath to study seriously and determinedly Sir John Herschell's treatise on Astronomy, particularly the chapter on "Perturbations;" and when he can sincerely assure himself that he *clearly* understands the reasoning so beautifully and familiarly culled, in that treatise, from the labours and almost superhuman sagacity of such men as Newton, Laplace, Lagrange, &c.; then, and not till then, ought he to consider himself entitled to form even a private judgment, much less to express a public opinion.

If Mr. Heath had given himself the trouble to *read* before he *wrote*, he would have found that it is *not* supposed that the axis of the equator will *ever* coincide with that of the ecliptic; neither has the approach of those axes any thing whatever to do with the precession of the equinoxes, which is a perfectly distinct phenomenon. He would have learned also that there is one consideration (amongst many) which ought to carry instant conviction to any reasonable mind of the truth of the theory of "perturbations;" and it is this,—that the fact of a change in the obliquity of the ecliptic was for a long period attributed, not to a real change, but to *errors of observation*; and it was not until *theory* had demonstrated that such change was an inevitable result of the system, and had even fixed its amount, that the correctness of the observations was admitted.

I fear Mr. Heath will not understand me when I tell him, that he has in his diagram merely converted the sidereal year into a synodical period of the three bodies H K M, and the tropical year into a revolution of 360 degrees: but perhaps he may better perceive the absurdity when he is told that the lines H M, I M, are really parallel; and consequently coincident with H K, I L.

NAUTILUS.

Leeds, Dec. 21, 1839.

P.S. When so many clever correspondents of yours in a late discussion, so pertinaciously insisted upon the possibility of assigning values to the precession of the equinoxes of the *other* planets, they must, I should suppose, have confounded it with the motion of their nodes, which is a very different thing. To the latter, values may be, and are, assigned by observation from the earth; but to the former a value can be assigned only by the inhabitants of each planet.

MILLS AND FACTORIES OF MANCHESTER.

(Abridged from "Manchester As It Is.")

The mills and factories of Manchester are of various sorts, viz. :—Cotton-spinning mills, silk-spinning mills, woollen-spinning mills and factories, smallware factories, and power-loom weaving factories.

Cotton Mills.—A few particulars respecting the mills belonging to Messrs. Birley and Co. may not be uninteresting, especially as they will convey an idea of the capital employed by a single establishment, certainly one of the largest in Manchester. The number of hands employed by this firm is 1,600, whose wages annually amount to the sum of 40,000*l*. The amount of moving power is equivalent to the labour of 397 horses. The number of spindles in the mills is about 80,000. The annual consumption of raw cotton is about 4,000,000 lbs. weight! The annual consumption of coal is 8,000 tons. It will perhaps excite surprise in a person unacquainted with the nature of machinery, when informed that the annual consumption of oil, for the purpose of oiling the machinery, is about 5,000 gallons; and the consumption of tallow, for the same purpose, 50 cwt. The annual cost of gas is 600*l*. One room alone, belonging to this firm, contains upwards of 600 power-looms. Besides the hands engaged in the cotton department, the following description of mechanics are employed in this mill :—

Millwrights,	Painters,
Mechanics,	Moulders,
Joiners,	Turners,
Bricklayers,	Smiths.
Plumbers,	

The establishment in which the fabric is manufactured for waterproof clothing, such as "*Macintosh Cloaks*," belongs to Messrs. Birley and Co. and is a part of their concern. The number of hands employed in this business, varies from 200 to 600. The immense amount of 250,000 lbs. weight of Indian rubber is annually consumed in the process of manufacture, to dissolve which, 100,000 gallons of spirits are employed.

The method of paying the wages of the work-people in Messrs. Birley and Co.'s establishment, is one that is worthy of imitation, and ought to be made known. By procuring a large amount of silver and copper every week, each individual receives his or her wages *separately* before leaving the premises, thus obviating the necessity of going to the public-house or beer-shop to seek change, a practice much too general on Saturday evenings. To a stranger the paying of so large a number of work-people would *appear a work of some difficulty*, but *so excellent are the arrangements*, that the whole amount is counted and distributed for payment, by one individual, in about two hours.

Silk Mills.—One of the most interesting of these mills in Manchester is that belonging to Mr. Louis Schwabe, situate in Portland-street. Mr. S. spins, or throws, and dyes his own silk, and manufactures nearly all descriptions of silk damasks and brocades. The silks for the decoration of the most magnificent apartments in the mansions of the nobility, and also of the royal palaces, are furnished from this concern; some of these splendid silks sell as high as seven guineas per yard. To produce this work, which is held in so much estimation, the Jacquard machine is principally employed, and also the machines for embroidering; the latter are only in use at this establishment, as Mr. S. now holds the patent for this invention. Under the superintendence of Mr. S., the productions of this beautiful machinery have been brought to such perfection, that any quantity of the most complicated embroidery, comprising an infinite variety of brilliant colouring, can be produced, and, when compared with the years of constant and fatiguing exertion consumed in producing work of a similar description in former times, in a very short space of time.

Smallware Mills.—In these establishments, of which there are several in Manchester, the articles of cotton, worsted, and silk tapes are very extensively manufactured. To trace the various processes a piece of tape passes through, and the various employments it affords, before it comes into the market, is a very curious and interesting occupation. Beginning, then, with the first commercial operations,—the cotton used in the manufacture of tapes, having been warehoused in Liverpool, is sold on account of the importer, and bought to the order of the manufacturer by cotton brokers. It is conveyed by canal or railway to Manchester; and when delivered at the works of the purchaser, is weighed, assorted, mixed, and spread, with a view to obtain equality in the staple It is then taken to the willowing machine to be opened and rendered floculent; thence it is transferred to the blowing machine, which cleanses it from dust, and makes it feathery. Attached to the blower is a lapping apparatus, by which the cotton is taken up and laid in a continuous fleece upon a roller, in order that it may be conveniently carried to the carding engine, there to be made into a fleece of the most equable texture possible; hence it is handed to the drawing frame, where it is blended with the production of all the carding engines connected with the particular set or system to which it belongs. It is next passed through the slubbing frame, after-

wards through the jack or roving frame, and then through the throstle or spinning frame, upon which it is made into yarn or twist. From the throstle, the yarn, if intended for warp, is forwarded to the winding frame, but if intended for weft, to the reeler; afterwards, that which is wound is delivered to the warper, that which is reeled, to the pin winder. The weaver next operates upon it, passes it through the loom, rubs up the tape, and consigns it to the taker-in, who examines the fabric, and transfers it to the putter-out, who sends it to the bleacher. When bleached, it is handed to the scraper, whose business it is to take out the creases, and open the tape, by running it under and over iron scrapers. This having been done, the piece is put through the callender, when it is pressed between hot bowls and rendered smooth and glossy. It is next taken to the lapping department, where it is neatly folded by young women, after which, the making-up forms the pieces into parcels, containing the required quantity, and places them in a powerful press to make them compact. He next papers them, and sends them to the warehouse, for sale.

Thus in its progress, from the raw material, a piece of tape has afforded employment to the broker of the merchant, to the broker of the manufacturer, to the carrier, to the mixer of the cotton, to the tenters of the willow, of the blower, of the carding engine, of the drawing frame, slubbing frame, roving frame, and throstle; to the doffer, bobbin-winder, reeler, warper, pin-winder, weaver, taker-in, putter-out, bleacher, scraper, callander-man, lapper, maker-up, and salesman; or, to at least twenty-five persons before it leaves the warehouse of the manufacturer, where 12 pieces, of 18 yards each, or 216 yards of cotton tape, of nearly half an inch in width, and containing 9,170 yards of yarn, are sold for eighteenpence; or 12 yards of finished tape containing 509 yards of yarn, for the *small sum of one penny*.

Some idea of the extent to which this manufacture is carried on in Manchester may be formed from the fact, that, at the works of Messrs. Wood and Westheads, upwards of 1,240,000 yards of goods, not exceeding three inches in width, and composed partly or entirely of cotton, linen, silk, or worsted, are woven in *one week*, or upwards of 35,227 *miles* in *one year*.

STEAM-BOILER FLUES AND CHIMNEYS.

At the quarterly meeting of the "*Geological and Polytechnic* Society of the *West Riding of Yorkshire*" (an apparently well-managed and flourishing scientific institution) which was lately held at Leeds, Mr. Hartop made a communication "On the boilers of steam-engines, and the construction of engine chimneys," in which some points in the economy of the steam-engine not usually adverted to were commented upon. The following is an abstract of his remarks. He stated that a very general opinion prevailed amongst practical men since the introduction of the excellently arranged waggon boiler of Watt, that whenever the length of the boiler exceeded four times that of its grate (say 25 feet), such additional length was useless, as to the quantity of steam produced, although a considerable degree of heat always passed away up the chimney. The cause of this I conceive to be that the heated air in these flues passes last, and therefore when at its coolest, through the side flues, by which it is brought in contact with the water near the surface in the boiler, and therefore at that point where it was the hottest; in consequence of which the boiler, if made very long, might re-impart a portion of its heat to the air in the flues before it passed to the chimney. There is one very great disadvantage in the cylindrical boiler, which, from its simplicity and strength, is becoming a very fashionable one, viz., that the incrustation will all collect in that portion of the boiler which is nearest the fire, and being a non-conductor of heat, will expose that portion of the boiler which lies between the fire and such incrustation to be burnt away. The argument in favour of this boiler, derived from "the ease with which it may be repaired," is therefore more than done away with by its so often standing in need of that repair which in well constructed boilers will not be required for the first 12 or 14 years. The Cornish boiler consists of an outer cylindrical case, having an inner tube passing through its whole length, in one end of which the fire bars or grate is placed, by which arrangement the heated air and flame is made to pass nearest the surface of the water in the boiler, where both air and water are the hottest; the former then returns through the side flues, and, descending under the grate, passes under the boiler last, where both the heated air and water are at their coolest, so that in a boiler of sufficient length the whole heat given out by the fuel may, under this arrangement of the flues, be imparted to the water in the boiler, and it is consequently found in Cornwall that they may be used to advantage to the extent of *fifty feet in length*. I am induced to take up this subject in consequence of my not having found these points hinted at either in the very excellent practical work on steam-engine boilers by Mr. Armstrong of Manchester, or

elsewhere. I may here also mention the very great importance it is to the owners of steam-engines that the iron selected for these boilers should be of a proper quality for that purpose, for I have known many instances of the bottom of boilers being entirely worn out in eighteen months, instead of lasting nearly *as many years*, the kind of boilers in both instances being in every respect the same, from which circumstance there can be no doubt that it is on the real stamina of the iron from which the boilers are made that their goodness or goodfornothingness depends. Connected with this subject is that of the chimney, which is very often carried to the height of 160 and 200 feet, and consequently made so small in the internal flue at the top as to cause the smoke to pass off with some difficulty. Having about eighteen years ago built one 110 feet high with its internal flue wider at the top than at the bottom, it was found in practice to answer so well that on applying fourteen puddling and other furnaces to it, the draft up to that point seemed rather to be improved with each additional furnace than impeded. I now find the practice becoming a general one in Scotland and Lancashire, which I attribute to my having mentioned the circumstance from time to time to my friends; and I do not hesitate to say that in good situations 80 feet will be found an ample height for the largest engines, and 100 feet in situations less favourable.

REGISTRATION OF NEW DESIGNS AND PATTERNS.

On the 1st day of July last, the "Act to secure to Proprietors of Designs for articles of manufacture the copyright of such designs for a limited time," came into operation. From that date up to the 24th of the present month 149 designs have been registered.

The following is an abstract of the principal provisions of the Act.

1st. New designs for manufactures in metals are protected for a term of *three years*.

2nd. Designs or patterns intended to be worked in or on, printed on, or painted on, tissues or textile (*i. e.* woven) fabrics, excepting always Lace, Muslins, Calicoes, and all such other articles as are protected by preceding Acts of Parliament, are protected for *one year*.

3rd. Any kind of impression or ornament, on any article of manufacture not being a woven fabric and not of metal, whether such impression is produced by modelling, casting, embossing, chasing or engraving, or in any other manner, is protected for one year.

All novelties in the shape or configuration of articles of manufacture (except as before excepted), are protected for one year.

But in every case it is necessary, in order to protect a design from piracy, that it should be registered, and a Certificate of Copyright obtained, *before it is made public*.

The fees payable at the Registration Office upon making the entry of a design are not regulated by the Act; but the Board of Trade under its authority have fixed the following rates:—Three guineas for the registration of an article of metal for three years, and one guinea for any other articles for one year. Drawings and other documents required in the matter will make the average *cost of registration to the proprietor* of a design in metal about five guineas, and of other articles between two and three guineas.*

The provisions by which Proprietors of registered designs are protected are very stringent, and are likely to be effectual in preventing infringement. The process to obtain redress is simple, the penalty on infractors of the law heavy, and the operation summary. We give this clause of the Act verbatim. It enacts—

"That during the existence of such exclusive or partial right no person shall either do or cause to be done any of the following acts in regard to a registered design, without the licence or consent in writing of the registered proprietor thereof, (that is to say)—

"No person shall use for the purposes aforesaid, or any of them, or print or work or copy such registered design, or any original part thereof, on any article of manufacture for sale.

"No person shall publish, or sell, or expose to sale, or barter, or in any other manner dispose of for profit any article whereon such registered design or any original part thereof has been used, knowing that the proprietor of such design has not given his consent to the use thereof upon such article.

"No person shall adopt any such regis-

* The Editor of the *Mechanics' Magazine* (Mr. Robertson) will be happy to undertake the registration of designs for any of his readers or correspondents, and to give them every information upon the subject, either by letter, post paid, or personally at his office in London. Mr. Prosser, (of No. 2, Cherry-street, Birmingham), Mr. R.'s agent for the Midland manufacturing districts, will also transact business upon the subject with those to whom the locality of his residence may be more convenient. Address, "Patent, and Design Registration, Office, 166, Fleet-street, London."

tered design, on any article of manufacture for sale, either wholly or partially, by making any addition to any original part thereof, or by making any subtraction from any original part thereof.

"And if any person commit any such act he shall for every offence forfeit a sum not less than 5*l.*, and not exceeding 30*l.*, to the proprietor of the design in respect of which such offence has been committed."

There are several faults in the Act which have prevented its working being of so beneficial a tendency to manufacturers as was expected, but these will, we understand, be remedied in the next session of parliament, at which time we shall probably have something to say upon the subject generally.

We are happy to be able to present our readers with the first of a series of monthly lists of the designs registered. The subjoined are all that have been entered during the present month. We are indebted to the courtesy and kindness of F. H. Long, Esq., the Registrar, with the permission of the Board of Trade, for this information, which will be continued from month to month.

LIST OF DESIGNS REGISTERED IN DECEMBER, 1839.

Date of Registration. 1839.	Number on they Register.	Proprietor's Name.	Subject.	Time for which the protection is granted.
Dec. 2.	116	Henry Chany	A scale	3 years
3.	117	William Evans	Stained paper	1
3.	118	Ditto	Ditto	1
4.	119	Thomas Horne	Cornice pole ring, or curtain ring, &c.	3
5.	120	William Lund	Weighing machine	3
6.	121	Gabriel Riddle	Letter weight	3
6.	122	William Lund	Ditto	3
9.	123	Ibotson and John Walker	Cantoon	1
10.	124	Gabriel Riddle	Letter weight	3
12.	125	A. F. Osler	Ditto	3
16.	126	Williams, Coopers, Boyle and Co.	Stained paper	1
16.	127	William Lund	Letter weight	3
19.	128	G. R. Metzler	Pianoforte damper	1
20.	129	J. E. Huxley	Stove	3
20.	130	H. B. Wright	Letter weight	3
23.	131	Ibotson and John Walker	Cantoon	1
23.	132 to 147	William Evans	Various designs of stained paper for paper hangings	1
23.	148	Joseph Ashton	An invention for consuming, &c., gas, &c.	3
24.	149	Thos. Messenger and Sons	Lamp	3

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 27th NOVEMBER, AND THE 24th DECEMBER, 1839.

George Davey, of Llandndno, Carnarvon, mining agent, for an improved mode of applying water power. Patent dated December 2; six months to specify.

Luke Hebert, of Birmingham, engineer, for improvements in the mechanism and process of packing and pressing various articles of commerce (A communication). December 2; six months.

Miles Berry, of Chancery-lane, draughtsman, for certain improvements in machinery or apparatus for making or manufacturing pins and sticking them in paper. (A Communication.) Dec 2; six months.

Godfrey Anthony Ermen, of Manchester, cotton-spinner, for certain improvements in machinery or apparatus for spinning, doubling, ortwisting cotton, flax, wool, silk, or other fibrous materials, part of which improvements are applicable to machinery in general. December 2; six months.

John Evans, of Birmingham, paper-maker, for *improvements for* chemically preparing and cleans*ing of felts used by paper manufacturers.* December *2; six months.*

Henry Dunington, of Nottingham, lace-manufac*er, for improvements* in machinery employed in making frame-work, knit, or stocking fabrics. December 2; six months.

James Guest, junior, of Birmingham, merchant, for improvements in locks and other fastenings (being a communication). December 2; six months.

George Saunder, Clerk of Hooknorton, Oxford, and James Wilmot Newberry, of the same place, farmer, for improvements in machinery for dibbling or setting wheat and other grain or seed. December 2; six months.

Henry Trewhitt, of Newcastle, Esq., for certain improvements in the fabrication of china and earthenware, and in the apparatus or machinery applicable thereto (A communication). December 4; six months.

Christopher Nickels, of York-road, Lambeth, gentleman, for improvements in propelling carriages (A communication). December 4; six months.

Pierre Narcisse Cronier, of Fricourt's Hotel, Saint Martin's-lane, for improvements in filters and in the means of cleansing the same, and for separating, colouring, and tanning matters by filteration, and for improvements in employing such tanning mat-

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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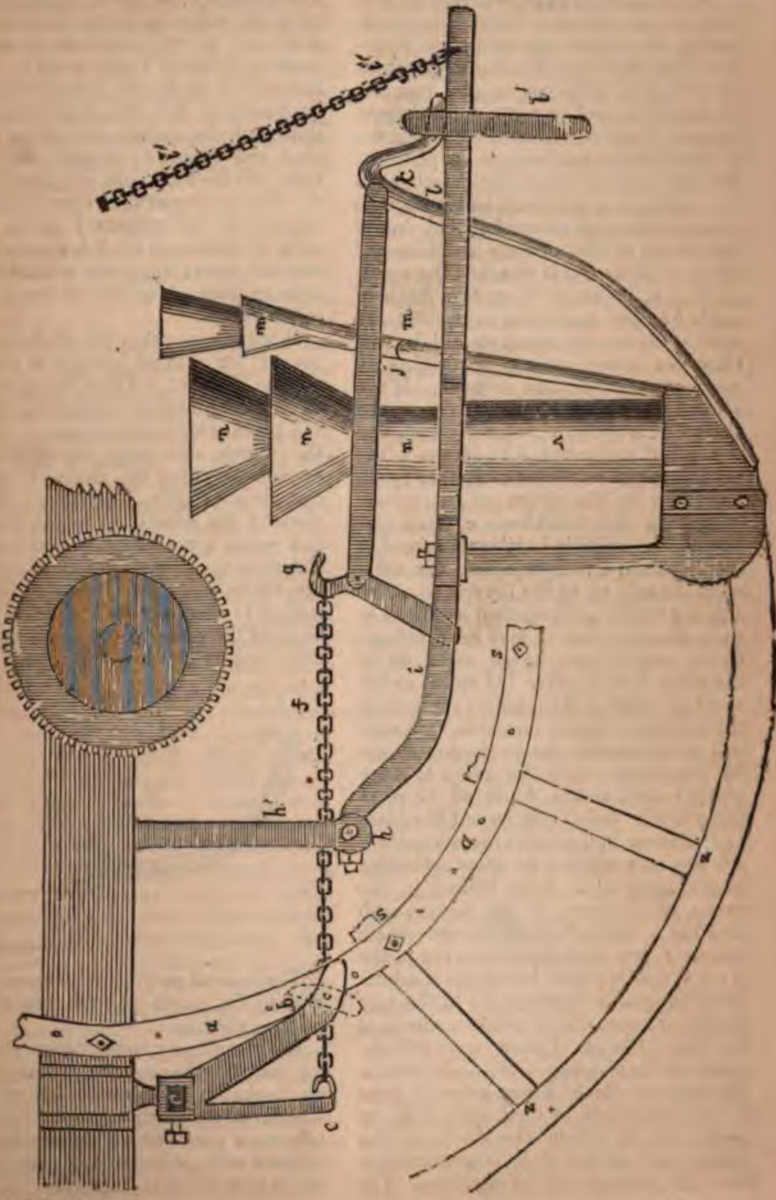

GROUNSELL'S IMPROVED CORN AND MANURE DRILLING MACHINE.

Fig. 1.

GROUNSELL'S IMPROVED CORN AND MANURE DRILLING MACHINE.

[Patent dated 12th June; Specification inrolled 12th Dec., 1839.]

Figure 1, front page, is a side view of part of an ordinary drilling machine, having the improvements applied thereto. The object of the improvements is to drill corn, grain, pulse, and manure, at intervals, and not in a continuous stream; the intervals or distances apart of such drilling can be varied at pleasure. The first part of the invention relates to the application of valves, and apparatus to work them at intervals. On one of the wheels of the drilling machine (of which *z z* is a part) is attached the circular ring *a*, in order to carry a series of studs *b b*; and according to the distance such studs are set apart, so will be the closer or wider sowing or drilling of corn, grain, pulse, and manure. If the several holes formed in the ring *a*, be tapped with suitable female screws, and the end of each stud *b* be screwed, the studs may be set closer or farther apart, according to the desire of the person employing the machine. *c* is an axis turning in suitable bearings in front of the machine; *d* is a projecting arm affixed to the axis *c*; on the lower end of the arm *d* a curved prolongation is hinged in such manner, that it may be lifted upwards, and will not be so acted on by the studs *b*, as to move the valves in the event of backing the machine; but when the machine is drawn forwards, each stud will strike against the projection *d*, and by this means cause the axis *c* to move partly round, and in doing so to open the valve or slide, and let out the grain and manure in the following manner:—*e* is one of a number of arms according to the number of drills affixed to the axis *c*, as is shown in the figure; each arm has a chain *f* affixed thereto; these chains *f* are also attached to the hooks *g*: *h* is another axis below the machine which moves in bearings *h'*; to this axis is affixed arms, one of which is shown at *i*. The number of such arms will depend on the number of the drills used in the same machine. These levers or arms *i* are supported at their outer ends by chains *i'*, by which the depth of the lower end of the drill is permitted to enter the ground will be regulated. The stems of the hooks *g* are attached by pin joints to the arms *i*, and to the stems *g* are attached the connecting rods *j*, which connecting rods each embrace its respective drill, and they are attached to the levers *k*, which at their lower end carry the valves or slides which close the drill; the levers *k* each move on a fulcrum at *l* affixed to the arms *i*. When the studs *b* act on the lower end of the projection of the arm *d*, the valves or slides will be opened, and allow of the seed and manure to pass, and again close, till the next stud *b* strikes the arm *d*. The closing of the valves or slides is assisted by the weights *l'* on the upper parts of the levers *k*. A A represents the coulter pipes; they are carried by the arms or levers *i*, and are of the ordinary construction.

It will be seen that the machine is arranged for drilling manure at the same time as the seed, the seed being supplied in the usual manner through the funnels and tubes *m m*, and the manure through the funnels and tubes *n n*, which are as usual suspended on chains to allow of considerable play. Variations may be made in the details, by which the slides and valves are acted on, in order to open and close them so as to sow at intervals, the valves or slides being suitably arranged to close the drill when shut, and allow of the grain, corn, pulse, and manure passing freely, when open.

Fig. 2.

The second part of the invention relates to the mode of supplying the manure to the tins.

In the ordinary construction for drilling manure, the projecting arms *o o* fig. 2 on the shaft *p* are spoons or hollow ladles, which, in the revolution of the axis *p*, take up a quantity of the manure, and effected without increasing the quantity of the area of floats immersed.

throw it over the shaft p into the hoppers or funnels leading to the coulter pipes. Mr. Grounsell causes the shaft p to turn in the opposite way to that now practised, by suitable gearing, and then the projecting arms, in place of being ladles to take up and carry over the manure, act simply by their broad concave ends drawing the manure to the hoppers or funnels. It is not necessary to enter into a description of the construction and working of ordinary drills, they being well understood; the improvements alone are described.

REMARKS ON MR. RENNIE'S "COMPARATIVE EXPERIMENTS ON PROPELLERS."—BY J. P. HOLEBROOK, ESQ.

Sir.—As one who has devoted much time and attention to making experiments upon various propellers, with a view to the improvement of the means of carrying on navigation by steam, I trust I may be allowed to offer the following observations upon the article, "Comparative experiments on propellers of different kinds," inserted in the last number (No. 854) of your very valuable periodical. My object in making these observations is to show that, however the results, as given in the communication, may warrant the conclusions drawn from them, these results have been obtained under such conditions of experiment as to render the conclusions of no value whatever, in the way of comparison of the useful effects of the different propellers with which the experiments were made. I hope that in offering my reasons for my difference in opinion from the author of the article in question, I shall stand excused from any desire to set up my views in absolute opposition to those of one with so high a name as Rennie; but rather, that my motive will be considered to be, a desire to show that in the ardour of experimenting, circumstances may be sometimes disregarded, which more coolly weighed, would be deemed altogether destructive of confidence in conclusions deduced from the results of experiments.

I may, perhaps, begin by stating that trapezium-shaped floats are no novelty *to me*, having experimented with them five or six years ago, and *since* discarded *them, from a perfect conviction* that when they were tried under equal conditions with rectangular floats, they were less efficient.

The first table, in the article in your last number, consists of the results of two sets of experiments with the different floats, immersed in two different degrees. From the table above, it is not easy to imagine the measures of the floats, though, from the conclusions drawn from the results, these may pretty well be defined, as well as the manner of placing the floats upon the two wheels. From the conclusions we learn, that the area of the trapezium float was half that of the rectangular float, while the trapezium float was one-third of the breadth of the rectangular float. Now, if the acute and obtuse angles of the trapezium floats were placed at the same distance from the centre of the wheel, as the inner and outer edges of the rectangular floats were, it is not easy to conceive that a trapezium, formed within the space occupied by a rectangular figure, and of half the area, and revolving in the same circle of action, could receive a resistance equal to that given in the table. We are, therefore, driven to conclude that, while the inner edges of the rectangular floats, and one of the angles of the trapezium floats, were placed at the same distance from the centre of the wheel, the other angle of the trapezium float, from the greater radius of this float, projected far beyond the outer edges of the rectangular floats, and, as a consequence, operated through a larger circle of action, in the same manner as would the rectangular floats of a larger wheel; and thus, the trapezium floats were resisted by the water, through an arc of a larger circle. Indeed, we are warranted in assuming thus much, by the third table of experiments, in which the greater comparative resisting action of the trapezium floats, is obtained by this manner of placing the floats upon the wheels.

There appears to be some mistake in stating the area of floats immersed in the first table; for we find, upon examination, that while the resistance of the rectangular floats is doubled, the area of floats immersed remains precisely the same, and this remark may apply, in a mitigated degree, also to the trapezium floats. I have much difficulty in imagining, how the immersion of the floats of a wheel, to double the extent, can be

By the first table we find that the different immersions of the two wheels, produce very different results, as regards the resistance of the water. If we have been right in supposing the trapezium floats to revolve in a larger circle, there is no difficulty in explaining that this difference of resistance is a very natural result. In a larger wheel it may happen that the first state of immersion may cover with water all the floats which would be immersed, if the immersion of the wheel were greater, while the lower floats of a smaller wheel may have a larger area of floats immersed upon a greater immersion of the wheel. A few circles drawn, and a trifling degree of reflection, will demonstrate the truth of this assertion.

The first conclusion, drawn from the first table is, "that the trapezium-shaped float, having only one-third of the breadth and one-half of the area of the rectangular float, has an equal resistance." To this, I think, should be added, *provided the centre of gravity of the trapezium float be pushed out so far from the centre of the wheel, that, by acting through a longer arc in the water, the resistance received, by the increased length of the arc, may be equivalent to the resistance, not received in consequence of the area of the floats immersed being less.* Now, sir, as the amendment I have proposed implies a vast alteration in the conditions of the experiments, and, as with such alteration, the resistance of the rectangular floats would be increased, the conclusion, without the amendment, is not correct, while, with the amendment, it is altogether useless.

The second conclusion, drawn from the first table, is, "That when both kinds of floats are immersed to double of their ordinary immersion, the resistance of the trapezium float is only one-half of the rectangular float." To this conclusion I would add, *provided the circles in which the two different sorts of paddles move, are such that, the increase of immersion of the wheel, with the trapezium floats, shall cause no more area of floats to be immersed, while the same increase of immersion of the wheel, with the rectangular floats, shall cause a large increase in area of the floats to be immersed.* It must be seen that, if my amendment to this conclusion be adopted, the whole conclusion becomes of no value.

I will now continue, in the words of the author of the article in question, and say, "If this remarkable property of the latter, of working nearly as well under water as when plunged to the usual depth, holds good on a great scale, the difficulties experienced by steamers in the early period of their voyage, when deeply laden with coals, and when the engines can only make half their usual number of strokes, is overcome, and their voyages are likely to be considerably shortened." Sir, no such remarkable property resides in the trapezium floats, when rectangular floats are employed under favourable conditions. For, supposing that the trapezium and the rectangular floats are placed upon the two wheels, with their centres of gravity at an equal distance from the centres of the two wheels, and that the rectangular floats are of such a size, as to receive from the water, at the less degree of immersion of the wheels, exactly the same resistance that the trapezium floats receive, at the same degree of immersion, we shall find that a double degree of immersion will scarcely produce any difference in the increased resistances of the water to the floats of the two wheels, because, in such a case, the rectangular floats, being of less radius, will cause proportionately more of their areas to be immersed with the less degree of immersion, and will also cause the unimmersed floats to come less soon into contact with the water, with the greater degree of immersion. With trapezium and rectangular floats, placed as we have just supposed them to be, the diameter of the wheel could be lessened, without the width being increased, which change could not be effected in the case of the trapezium floats being used.

But, Sir, the remarkable property, supposed to reside by Mr. Rennie in the trapezium floats, so far from being likely to hold good under the circumstances he supposes, does not possess this property in the same remarkable degree in the next table of experiments; in which we find that, while the men take one minute to perform 41,8 revolutions of the winch, they make, under the best circumstances of trapezium floats, 47,5 revolutions in the same time, which is equal to 41,8 revolutions in about 53 seconds. Now as, in the first table, the resistance of the different floats was as-

sumed to be regulated by the times necessary for a weight to fall through a certain space, we may, in like manner in the present case, supposes the resistance of the deeply-immersed different floats of the second table to be equal to the times taken by the men to perform a certain number of revolutions; and, as we find that 60 seconds are required by them to make 41,8 revolutions, with the rectangular floats, and only about 53 seconds to perform the same number of revolutions with the trapezium floats, we may reckon the resistances of the rectangular, as compared with the trapezium floats, to be as 60 to 53, whereas, if the trapezium floats possessed, in the degree assumed, the before-mentioned peculiar property attributed to them, the numbers ought to be 60 to 30.

I trust, I have said enough to show, that, under equal conditions of experiment, the trapezium floats do not receive the same resistance from the water that is received by the rectangular floats; and also that, under the same conditions, the resistances against these two sorts of floats being equal with one degree of immersion, no great difference will take place in the increased resistances of the different floats, with a greater degree of immersion.

I now take leave of the first table of results, and come to consider those we find in the second table, in which a comparison is made between the screw propeller, the conoidal propeller and wheels, with differently-shaped floats.

The first remarkable fact in this table is, that the screw propeller, having 226 inches of immersed area, and being 17 inches in diameter, is less resisted by the water than the conoidal propeller, which has only 144 inches of immersed area, and is of the same diameter. Now as the principle, upon which resistance is derived from the water, is the same in the cases of the screw, and of the conoidal propeller, this resistance depending upon the disposition of the thread of the screw of each, as regards its distance from the axis round which the thread revolves, and upon the inclination of this thread with the axis, I presume that the thread of the screw propeller, in the case under consideration, made a very large angle at *its exterior part* with the *axis, and, consequently,* required more velocity to produce a good propelling effect; while, in the case of the conoidal propeller, I suppose that this inclination was less, and, consequently, that the resistance of the water was greater; but, of this I am sure, that were the threads of the screw and of the conoid placed at the same angle, and the surface of resistance so much greater in the case of the screw, as in the case under consideration, and the two instruments made to revolve at the rates set down in the table, I am sure, I say, that the screw would have had a vastly superior propelling effect over the conoid. It is, certainly, true that the thread upon the screw may have had two turns instead of one, in which case, the increased surface of resistance would have been in a manner neutralised: but, as we cannot suppose this to have been the form of a screw intended for a propeller, I will make no remarks upon an instrument thus constructed.

Let us now compare the results obtained, in the case of the conoid, with those obtained from the paddle-wheel with rectangular floats. Upon examining the conditions of experiment, we find the wheel to have been fitted with 12 floats, of which six were entirely immersed. To have six floats out of 12 entirely immersed, is nearly equivalent to immersing the wheel to the axle. Of all the modes of working a wheel with rectangular floats, we can scarcely imagine one less fitted to produce a useful effect than this mode of immersing the wheel nearly to the axle, unless we suppose it to be totally immersed, when it would be almost impossible to get any propelling effect at all from the wheel. Notwithstanding the improper degree of immersion of the wheels, in the experiments under consideration, we find the men worked 135,5 seconds with the conoid, and 155,25 seconds with the common paddle-wheel, working with the latter about 20 seconds longer than with the former instrument. When we consider that the conoid was worked under the most favourable immersion, and the paddle-wheel under almost the worst, we are justified in assuming for the paddle-wheel, from the results in the table, a vast superiority; for, if it still propelled the boat the same distance, in 20 seconds more only of time, than that necessary in the case of the conoid, when

some of its floats were, not only not acting to propel the boat, but, on the contrary, nullifying the action of those floats which were propelling it, how differently would it have propelled the boat, if only three, or less, of the floats had been entirely immersed. The great quantity of float surface immersed, in the experiment recorded in the second table, is the very cause of the unfavourable result, as regards the common paddle-wheel; and, instead of this great quantity tending to produce a better result, it is, on the contrary, calculated to produce a reverse effect—this is one of those cases in which addition is, substantially, subtraction.

If we compare the 3d, 4th, and 5th experiments of the second table, we shall find no material difference in the time taken or labour required, to perform the stated distance; but, if we look to the number of revolutions of the winch, we perceive that, despite the loaded state of the wheel, when fitted with rectangular floats, 108,25 revolutions were equivalent to 121,75, and 120,75 revolutions, when the wheels, with trapezium floats, were used, thereby showing that the propelling effect of the rectangular floats was, per revolution, more effective. Looking to the conditions of experiment of the second table, it is apparent that all the wheels, whether fitted with trapezium or rectangular floats, are, in consequence of their great immersion, worked under very unfavourable circumstances, and that of all the instruments worked favourably, the screw and the conoid are only so worked; perhaps, the conoid so alone.

The conclusions drawn from the results, set down in the second table, are, as far as these results go, correct; but, in respect of utility, of no value whatever, because the conditions under which they were obtained, were not those most suited to a good comparison of the effectiveness of the different propellers employed.

We now come to the last table, and of this I shall first observe, that the figures in the third and fourth columns, have, by some mistake, been transposed, and, consequently, should, therefore, be retransposed. If we attentively examine this table, we find the advantage, as regards *performance, to be* with the rectangular *floats; for, with* these, it takes fewer strokes of the engines, and less time to perform the stated distance, than with the trapesium floats; the speed, of course, being greater with the former than with the latter floats. Let us now examine into the advantages of the trapezium floats, and we shall best do this by quoting and amending the conclusions drawn from the table. The first conclusion states, "That with one-half of the area and one-third of the width, the trapezium-shaped propeller presented the same resistance as the rectangular float, while from its peculiar form, the total immersed area was two-thirds of the immersed area of the rectangular float." Instead of "one-third of the width," it should have been *rather more than three-fourths of the width;* because 18 inches (the width of the trapezium float) is not *one-third* of 23 inches (the width of the rectangular float) but *rather more than three-fourths* of that number of inches. This conclusion, thus amended, we will now further examine. It is stated that, with one-half of the area of the rectangular floats, the total immersed area of the trapezium floats, was two-thirds of the immersed area of the rectangular floats. This appears rather extraordinary at first sight, but, if we look at the measures of the two wheels, one being 7 feet four inches in diameter, and the other 8 feet 10 inches in diameter, we shall find that the trapezium floats revolve at a greater distance from the shaft, that more, consequently, of them, are partly immersed in the water, and that they move through a longer arc in the water. Had the rectangular floats been made to revolve at the same distance from the shaft, we should have seen very different results, in the resistance of the water against them.

Thus we see that this conclusion, like others, is founded upon results, obtained by a departure from equal conditions of experiment, and, being thus founded, is, like others, useless for purposes of proper comparison.

The third conclusion drawn is, "That the width of the paddle-box, and, consequently, the resistance of the wind, one-third will be diminished." For *one-third,* we should read *by almost one-fourth.* But though the *width* of the paddle-box would be diminished to the extent of almost one-fourth, or 5 inches, the height must be increased by 9 inches; because,

it is very clear, that a paddle-wheel, of 8 feet 10 inches in diameter, could not revolve in a box, made to fit a wheel of 7 feet 4 inches in diameter. We, therefore, see that, if the paddle-box could be diminished in width, and so receive less resistance from the wind, it must be increased in height, by which the resistance from the wind would be increased; consequently, it appears, that the gain would about balance the loss.

The fifth conclusion states, "That one-half the weight and present cost of paddle-wheels and boxes will be saved, while the vibratory motion, so disagreeable in most steamers, will be done away with." It does not appear clear to me, that, by diminishing the wheel *by not quite one-fourth*, the weight and cost of the wheels and paddle-boxes will be diminished to the extent of *one-half*; but, on the contrary, it seems to me, that, the most expensive parts of the wheels and paddle-boxes being required, as well in the case of a narrow, as in that of a broad, wheel, the saving, in weight and cost, will not increase, even as fast as the width is diminished. But, when we come to consider, that, the diameter of the wheel, and the height of the paddle-boxes, would be increased by the use of trapezium floats, we may very fairly set off the gain, in weight and cost, of the wheel and paddle-boxes arising from the diminished width of the wheels, against the loss, in weight and cost, arising from the increased diameter of the wheels, and the increased height of the paddle-boxes.

I would say a few words upon trapezium floats before I conclude. It is evidently impossible to obtain, from a trapezium float, formed within the space of a rectangular float, the same resistance from the water, as from a rectangular float; because, it is the amount of surface, which, in a great measure, determines the resistance, when the two floats move in the same circle. Therefore, instead of the width of the wheel being diminished, by the use of trapezium floats, supposing the diameter not to be altered, the width, will, on the contrary, be diminished, when rectangular floats are properly used. If, to enable the trapezium floats to receive more resistance from the water, we increase the diameter of the wheel, it should be borne in mind, that rectangular floats, placed on an enlarged wheel, will also receive a greater resistance from the water: in fact, make any change we may, the compact surface, of the rectangular float, will always receive a better resistance from the water; and, as a consequence, require a less number of particles of water to be put in motion; and, therefore, a less portion of power wasted, in putting water uselessly in motion, than can be received, by the surface of a trapezium float, under equal conditions.

In conclusion of these already too much lengthened observations, I beg to offer every apology for intruding them upon your attention, and, Sir, to subscribe myself,

Your most obedient servant,

J. P. HOLEBROOK.

Dec. 26, 1839.
168, Devonshire-place, Edgeware-road.

THE CALCULATOR, NO. 8—FURTHER APPLICATION OF THE SLIDE-RULE.

Sir,—The instances in which expeditious calculation is desired, though at the expence of accuracy, are very numerous. In these cases it is necessary to be careful that the nature of the abridgement used gives an equal chance of error either way, so that in a number of similar calculations the totals of error in excess and defect may nearly balance each other.

To apply this principle to pen calculations often requires considerable knowledge of the theory of variations, or a great deal of practice in lieu of it: and in this point of view mechanical computation has a decided advantage.

Instruments in the nature of the slide-rule may in some cases be constructed and used with advantage, wherein v (see Calculator, No. 6) is not a function of $\frac{a}{b}$.

In one of the grooves of my "Pocket Calculator" are laid down 4 lines of the values of annuities at 3, 4, 5 and 6 per cent. Now if the groove containing these lines were made of 4 or 5 times, its usual width, and the lines proportionably separated from each other, curves might be drawn across them passing through the corresponding divisions of each, and parallel lines at equal distances between the original scales. These latter would be divided by the former into scales appropriate to intermediate rates of interest.

The case is not one of imaginary advantage. In the Life Annuity tables used by the Commissioners of the National Debt, a difference is made for every shilling in the market rate of interest; so that from 3¼ to 4 per cent. are 15 diferent numerical values. To a person therefore in the frequent habit of buying Government Life Annuities, a rule which, at one setting, would give the value of any sum of annuity at the price of the day would probably be very useful.

But if the breadth of the groove be enlarged, so must also the slide. The upper and under surfaces of the slide thus become open spaces available in the same way as the groove; especially if the tongue of the slide be placed in the middle of its thickness, allowing either surface to be brought uppermost.

I have in view an important application of the idea thus announced, of which I may have occasion to speak hereafter.

I am, &c.

J. W. WOOLLGAR.

London, 24 Dec., 1839.

NEW LETTER BALANCE.

Fig. 2.

Fig. 1

Fig. 3.

Sir,—Permit me to submit to your notice the accompanying sketch of a letter balance, the idea of which occurred to me a few days ago, and should you approve of the plan, perhaps you will do me the favour to insert it in your Magazine.

Fig. 1 shows at a glance the simplicity of the contrivance, and fig. 2, the minor details of the index and graduated tube.

On the shaft D is a black ring or circle which, when the instrument is at rest, without any extra weight, will be in a line with the first division on the small open tube marked O, and when by any superincumbent weight the shaft is forced lower down, the ring which surrounds it serves to indicate the weight of the letter by the degree of depression as shown by the lines on the tube.

Fig. 3 is intended to show the best structure of the index tube; the shaft is supposed to be turned of ivory, or some fine grained wood, very smooth and true, and in order to avoid unnecessary friction, the only points of contact are at B and at C, both collars being finely rounded and smooth.

The mode of action of the spiral spring, and relative details, are too clear and apparent to require further elucidation.

I am, Sir, your obedient servant,

I. B.

Monday, Dec. 16, 1839.

P. S. Although I had not at first the least notion of attempting to make such an instrument myself, yet, as I happened to have a small piece of reed by me, I purchased some wire, and adopting a quill for the index tube, succeeded last Saturday evening in completing one, all but marking the degrees. The ring of ink marked on the shaft of light-coloured mahogany, showed sufficiently clear through the quill to enable me to observe the descent; and I placed a letter on it, and made a mark on the quill. Since that, understanding that a half-crown, was nearly half an ounce, I ascertained, that it requires more than two such sheets as the one I am now writing upon (ordinary Bath post) to cause the ring to descend to the same mark which I made by the half-crown; and inferring from this, that one sheet was within a quarter of an ounce, I marked the upper line of the tube $\frac{1}{4}$, and then placing the half-crown over one letter $\frac{3}{4}$, another sheet or letter over that of course made the degree 1 oz., and so on.

Imperfect as this hastily-made little instrument must of course be, yet it operates to a tolerable nicety, and quite sufficient in most cases, except when the approximation to the half ounce, &c. happens to be very near; therefore I feel assured, that when the different parts are neatly turned and adjusted, that it will be equal to the several ingenious contrivances already before the public, besides, perhaps, having rather more facility of action.—I. B.

THE CLINOMETER.

[Communicated by the Inventor.]

Sir,—This instrument takes its name from two Greek words signifying a bed or *strata, and a measure; it is therefore intended for the purpose* of ascertaining the depth of soft mineral or earthy strata.

Explanation.—A, a cross piece for working the instrument; B, a strong pole graduated to feet, &c. for fixing to T a stout iron tube with an opening equivalent to $\frac{1}{3}$rd the circumference as shown at P. P, an inner tube to work freely upon the interior of T, of similar shape. K K, projections for opening and shutting the instrument; S, a suitable screw for working the instrument into the ground.

A simple and efficient instrument for this purpose has long been a desideratum. If a landed proprietor or surveyor is desirous of ascertaining the nature of the subsoil of an estate, or an engineer the subsoil of the bed of a river (as in the case of the Thames Tunnel,) with the means generally employed for such purposes, it becomes an operation of considerable time, trouble and expense. The landed proprietor or surveyor goes to work by taking with him one or two men with pick, shovel, &c., who commence operations (perhaps in the centre of a fine meadow) by digging an unsightly pit some three or four feet square, and so reach the required depths. The engineer on the other hand, will, supposing him to go about the job *sans ceremonie*, in the method at present employed, bring with him augers, borers, &c., and by abstracting the earth by little and little, arrive at the required information. But with my instrument the surveyor will soon accomplish his task. Throwing it over his shoulder as he would his gun, off he goes, and having fixed upon a spot, takes the cross piece, passes it through the hole at the top of the instrument, introduces the same into the ground, and works it down screw-fashion, from left to right, (the inner tube remaining shut.) After working it to the required depth, as indicated upon the stalk of the instrument, the motion is reversed, when the resistance of the projections upon the inner tube to the surrounding earth will cause the instrument to open and to charge itself with the soil at such depth. The motion being again reversed will cause the tube to close; when the instrument, being withdrawn, will be found to contain, pure unmixed soil taken from the required depth, that is, the soil through which the tube was passing when the motion of the instrument was reversed.

Trusting that this invention will be of considerable utility,

I am, yours, &c.

WM. JONES.

Manchester, Dec. 16, 1839.

BIRMINGHAM FIRES AND FIRE-ENGINES.

Sir,—While I was in Dudley a few *weeks since, I was present* at the trial of *new fire-engine recently* built for the Birmingham Fire Office by their townsman, Mr. Jones, and which had been placed in charge of Mr. James Brown, for the protection of Dudley and its neighbourhood.

In a printed circular addressed to the inhabitants of Dudley upon that occasion, the engine is described as "a most effective and powerful one, built expressly for this town, which discharges water both in height and volume, far beyond anything before witnessed *here*, being built with all the latest improvements.* The pumps are of a superior size and power, are constructed upon an entirely new principle, and so securely fitted that they cannot act otherwise than true, whatever pressure may be applied. In the hose, which is copper rivetted, there is also an admirable improvement, by which, the engine can be got much quicker into play than upon the old plan; this consists in Baddeley's *hose-reel*, around which, the hose is kept constantly jointed, instead of being in separate lengths, and can therefore be at once run out to the extent required, without the trouble, uncertainty, and waste of time heretofore occupied in joining the various lengths." Verily "a prophet is not without honor, *except*," &c.

Great mystery was effected as to the "*entirely new principle*," and I could obtain no satisfactory information as to the size of the pump-barrels or the length of the stroke. From this cause no very accurate estimate could be formed of the merits of this engine: judging from its performance, I should take it to be about a five, or five and a half inch barrel engine. The air-vessel was evidently much too small, (a common error with all young engine-makers) the jet of water dropping between every stroke. The water-ways of the hose-joints and branch pipe were much cramped and otherwise objectionable; the carriage part was an indifferent specimen of this class of work, and the wheels wretchedly small, they looked like low truck wheels, and are as little adapted for expeditious travelling as can well be imagined. From such observations as I was enabled to make, I suspect there is little that is "*entirely new*"—except the boxing up of the works so as to be wholly inaccessible: I suppose, upon the strength of the conviction

* Ignorance of the subject is the only justification that could possibly be offered for such a statement as this.—W. B.

that, "*they cannot act otherwise than true.*" If however there really is a "new principle" in this engine, I have no hesitation in saying its *novelty* is most assuredly its only recommendation; the lavish profusion of ornament stamps it at once as a production of the "gilt-toy" country.

At the station in Birmingham, they have two engines of similar construction but of larger dimensions, both furnished with my *hose-reel*, decidedly the best feature about them. Of these two engines, one is somewhat neatly painted drab, the other, like Joseph's coat is of "many colours," all redolent of gold and varnish. The construction is very lofty, and they are both decorated with a profusion of ornaments. Wooden battle-axes of an enormous size, richly carved and gilt adorn (?) the top; while a mass of cast iron scroll-work, also gilt, encloses the sides of the hose-reel.

The appearance of these engines seems altogether as if they were got up merely to give eclat to the annual procession of the Birmingham firemen at fair time; they would be at home to a T in our Lord Mayor's show—drawn by Gog and Magog after the "State coach"—or as some vulgar cockneys call it the "city barge;" in perfect keeping with the rest of that annual civic tom-foolery.

The object of these two engines in such different garbs, was kindly explained to me, and I hope your readers will not suppose me *Jonathanizing* while I repeat the explanation, which is this:—if a fire breaks out in the premises of any member of the *Society of Friends*, of which there are a large number in Birmingham, the *Drab* engine is dispatched to their assistance; but if the goods or chattels of *Jews* or *Gentiles* are in jeopardy, the *painted* engine is brought out! The liberality and delicacy of the Birmingham people in matters of theology, was notorious even in the days of Priestly—where will they stop now?

The gaudy *exterior* of the Birmingham engines, and the want of cleanliness in the *essentials*, form a striking contrast in experienced eyes, with the plain exterior, but excessively clean and polished furniture of the London fire-engines.

The extraordinary small number of fires that occur in Birmingham, and the general insignificance of their character, is matter of continual surprise to persons cognizant of such matters. No other town in the kingdom of equal extent and population suffers so little from fire, notwithstanding the extensive employment of fire-heat in most of the principal manufactures; were it otherwise, I fancy the fire establishments of this town would find it expedient to adopt more of the useful and less of the ornamental character.

I remain, Sir, yours respectfully.

WM. BADDELEY.

London, Dec. 28, 1839.

LIFE AND LABOURS OF TELFORD.
NO. 2.

Severn Bridges—Montford—Buildwas Iron Bridge—Tongueland Bridge in Scotland—The Ellesmere Canal.

The appointment of Surveyor to the County of Salop called into play the engineering resources of Telford's mind to some considerable extent. The county being intersected by the largest river in England, into which many tributaries also pour their streams, a great part of the duty of the surveyor consists in directing the building of the bridges rendered necessary by the increasing wants of the inhabitants, or the destruction by time or accidents of the old means of communication. The bridges over the secondary rivers are of comparatively easy execution, but the construction of a Severn bridge is an affair of no ordinary magnitude and difficulty. The first of these which fell to the lot of Telford was one at Montford on the road into Wales. This was composed of three elliptic arches, one of 58 feet span, and the other two of 55 feet span each: it was built of red sandstone brought from Nesscliffe Hill, a distance of four miles only, and although the nature of the soil of the river's banks, and the floods to which that part of its course is exposed, caused great difficulty, all obstacles were happily surmounted, and the bridge remains to this day in a perfectly sound condition. Its cost amounted to 5,800*l.*

The next large bridge erected was that of Buildwas, in place of a very ancient one, supposed to have been built by Roger Montgomery, the founder of the neighbouring abbey, as well as of Shrewsbury castle, which was carried away by an extraordinarily high flood in 1795. Here Telford determined on call-

ing to his aid the powers of a novel material in bridge-building, and one which he was destined to bring most extensively into use. About twenty years before, the proprietors of the Coalbrook Dale iron-works, together with the eccentric iron-master, John Wilkinson, had erected the first cast-iron bridge ever known, the celebrated one at Coalbrook Dale. These pioneers in a new system, and their architect (Mr. Pritchard) deserved great credit, not only for introducing the new material, but also for the manner in which it was effected; but they had not been able to disengage their ideas from the form most usual to the arch in masonry which in iron is very ungraceful, while at the same time it does not offer sufficient resistance to the pressure of the earth behind the abutments, which has consequently pushed them forward, and thus raised the iron arch in the middle.

To avoid these defects, Telford rested his roadway on a very flat arch, well calculated to resist the abutments, if disposed to slide inwards, while the flat arch itself was sustained and strengthened by an outer arched rib on each side of the bridge, springing lower than the former, and likewise rising higher, so that the principle of timber-trussing was made use of rather than that of masonry. The outer ribs rise as high as the top of the railing, and are connected with the lower ribs by dove-tailed king-posts. Each main rib of the roadway arch consists of three pieces, secured at each junction by a grated plate, which connects all the parallel ribs into one frame. Besides all this, the back of each abutment being in a wedge shape, throws off laterally much of the pressure of the earth. It is needless to add that this construction proved highly successful. The bridge was cast, on contract, by the Coalbrook Dale company in a style worthy of the design, at a cost of 6,034*l*. The span of the great arch is 130 feet.

A third Severn bridge at Bewdley, of less peculiar construction, was followed after some years by another in a very different locality, and for other parties. This was at Tongueland, near Kirkcudbright, in the south of Scotland. The river Dee being here subject to a tide of no less than twenty feet in height, or double the depth of the stream at low water, and the banks high and rocky, it was advisable to cross by one arch of 112 feet span. It was no easy task to support with centering an arch of such a size, and in such a situation; but this Telford happily accomplished. The principal novelty in this bridge was in the manner of filling up the spandrels, which in consequence of the great rise were necessarily very deep. Taking a hint from Edwards, the architect of the Pont-y-ty-Prydd, Telford perforated the mass of the wings, and thus reduced the pressure; while in the spandrels, instead of filling them up, as usual, with earth, he built a number of longitudinal walls—in fact, interior spandrels—the ends abutting against the back of the archstones and the cross-walls of each abutment. The longitudinal walls were connected and steadied by tie-stones, and at a certain depth under the roadway the spaces between them were covered with flat stones, so as to form a platform for the road, while arched spaces were left for access to examination and repair when necessary. Formerly the spandrels were filled with spongy earth and clay, a circumstance which caused the fall of the original bridge over the North Loch at Edinburgh, which made no small noise, and caused infinite alarm at the time of its occurrence. The Tongueland bridge, in regard to external elevation, is turreted and embattled, in imitation of a structure of the baronial times, which always retained a strong hold upon Telford's poetical imagination.

During the time of Telford's being engaged as County Surveyor of Salop, he executed no less than forty bridges, besides those over the Severn, some of them of tolerable magnitude. The two largest were of stone, of 80 feet span, and the three next in size of iron, each of 55 feet span. Of his more strictly architectural labours in the same period the principal was a new church at Bridgenorth, on account of which Telford himself laid claim only to the merit of simplicity and uniformity of design; and not with the greatest reason, if we may judge from the fact that, while the interior was of the pure Ionic order, the exterior was of equally pure Tuscan, and crowned with a spire of a Doric as pure as either! It may, perhaps, be safely allowed that the loss of Telford's talents to the world as an architect, was but little in comparison with its gain of his genius as an engineer.

approach an era in Telford's life; his engagement as en- he Ellesmere Canal, the first work on which he was em- one in the course of the exe- hich he displayed a skill and ich at once placed him in ank of the practical scien- of the day. The Duke of r had introduced canals about before, but it was not till that the people of Shropshire ir attention to the great im- them, of that mode of com- When once they were wever, there was no lack of eir part. Canal speculations rters had succeeded so well, ts of that description were ast as popular as railway at present, in proof of which entioned that, after the sur- he Ellesmere Canal had been e first general meeting for into execution, no less than he estimated amount of the s at once subscribed by the l-be shareholders. Of course, circumstances, matters went y on, an Act of Parliament tained, and operations com-

ect was a far more extensive night be surmised from its appears to have been given dentally on account of the lesmere being nearly in the s course, and happening also cene of the first meeting of . It consists, in fact, of a avigations, the principal one from the river Dee, in the 'ale of Llangollen, and pass- e towns of Ellesmere, Whit- d Nantwich, and the city of (what was afterwards term- re-Port, on the Mersey. The lines extended, one through f Salop to Shrewsbury on the e other by Oswestry to the ryshire Canal at Llanyme- whole line, including the nal (now incorporated with it), a distance of 103 miles, and means of transit for the rich productions, agricultural and most parts of the county of the tracts of country on its *ern border.*

When matters were so far arranged as to justify the commencement of practical operations, the committee of management looked around for a proper person to conduct them. The majority of this body consisted of magistrates of the county, who, having long observed the ability with which their surveyor carried his plans into effect, not unnaturally pitched upon Telford, and proposed that he should undertake the extensive and complicated work. He, "feeling in himself a stronger disposition for executing works of importance and magnitude, than for the details of house architecture," did not hesitate to accept their offer, and from that time forward directed his attention solely to the pursuit of *civil engineering*.

Telford's first task on regularly entering the new profession he was so well fitted to adorn, was by no means a light one. The country on the borders of Wales, through which the canal was to pass, was exceedingly broken and mountainous, presenting obstacles which it required extraordinary resources to overcome; and Telford *did* overcome them triumphantly—few even among his later works exceeding in ingenuity of conception and boldness of execution the celebrated aqueducts of Chirk and Pont-y-Cyssylte.

CUTLER'S IMPROVED ALLOY, OR COMPOUND METAL, AND IMPROVEMENT IN PIPE-MAKING.

[Patent dated Dec. 12, 1838; Specification inrolled June, 1839.]

This invention consists, firstly, in the forming of a new alloy, or compound metal, by the admixture with one another of *iron*, *copper*, and *nickel*, and the further combination of the compound metal thus produced with zinc and tin, or with one of them. A compound metal made of iron, copper, and nickel, is claimed either further compounded with zinc and tin, or any other metal or metals.

The proportions recommended are one pound of nickel to every ten pounds of iron, whatever be the quantity of iron used in the compound. The precise proportions of the different metals, however, must be suited to the purpose to which the compound is to be applied, observing that the greater the quantity of iron used the harder the compound metal that will be produced.

The proportions recommended for steam pipes, the principal use to which the invention is applicable, are as follows:—

Copper, 22 lbs.
Iron, 10 lbs.
Nickel, 10 ounces.

The proportions recommended for various other articles of manufacture are detailed, but no particular proportions claimed; but Mr. C. claims the mixture of the three metals in whatever proportions.

The processes recommended for melting and mixing the metals are also described at considerable length, but no particular process is claimed.

The second part of the invention is an apparatus for bevelling off the edges of a strip of this new compound metal, or any other metal, for the purpose of these edges being turned upon each other, and soldered or otherwise joined to form a pipe. This is effected by passing the edges between rollers adjusted and moved by suitable apparatus described by the patentee.

MACEWAN'S PATENT MODE OF PREPARING TEAS.

[Patent dated Aug. 5; Specif. inrolled Feb. 1839.]

A stove or close room must be provided nearly air tight, in which the temperature can be raised and nearly equally maintained to the degree hereinafter mentioned. A convenient stove for this purpose may be made of brick or stone, capable of containing from 20 to 40 chests of tea, or larger if necessary. The door should be so made, that when it is closed, the room should be nearly air tight. The heat may be conveniently communicated by steam pipes laid in various directions in the stove, so as to equally heat the whole. The particular form of stove or room, or the manner of heating, however, is not material. Such stoves or rooms will be sufficient as are now in common use as drying stoves for loaf sugar in the process of manufacture, and for various other purposes. The size of the stove or room is not essential. It should be adapted to the quantity of tea on which the process is required to be performed, and the heat may be applied in any of the ordinary methods for that purpose, such as by hot water or a cockle, as well as by steam. The tea intended to be submitted to the process should then be placed in the stove or room in the packages, and in the quantities and in the state in which they are ordinarily imported, and the stove or room closed. The temperature of the stove or room should then be raised to about 140° to 150° of Fahrenheit, and continued at that temperature to a period of from four to six days, by which means a moisture or sweating will be produced in the teas. It is not, however, necessary that the temperature sheuld be exactly maintained to that degree. Should it be somewhat less, the effect would be produced in a longer time, but if considerably less the effect is not so satisfactory, and as low as 95° of Fahrenheit, the improvement is very little if any. On the other hand the temperature may be somewhat higher, but care must be taken that the heat should not be too great, for if the temperature for any material time should be too great, say as high as 200°, the tea will probably be injured, and become what may be called burnt. The temperature before mentioned, of from 140° to 150° Fahrenheit, has been found to answer the best. If the tea has been imported in the usual manner and been warehoused for some months, four days will be found sufficient time for temperature to be continued, though a little longer will not be injurious. If the tea has been in any damp situation or has been very shortly landed from the vessel, a longer time will be required, according to the state. Six days has been found in all cases to be sufficient at the temperature of 140° to 150°. The package in which the tea is imported has been mentioned, and is well adapted for the process. The nature of the package is not essential, nor the particular quantity. The package, however, should be closed, as the moisture which arises in the tea during the process should not be allowed perceptibly to evaporate, or the flavour of the tea will be thereby lessened; and if the quantity is too small, say a few pounds, there is a danger of the tea becoming what is called burnt. When a sufficient time, as hereinbefore mentioned, has expired, the tea should be removed from the stove or heated room, and it may be placed in the ordinary stove-room and allowed to cool, and in one or two days, according to the temperature of the room, the tea will be fit for use.

MARS'S RIGHT ASCENSION AND DECLINATIONS FOR JULY, 1840.

The Editor of *White's Ephemeris* begs permission to insert in the *Mechanics' Magazine* correct R.[t], Asc.[n], and Dec.[n], for the month of July, 1840, in the place of those which were, by mistake, inserted in the Ephemeris, p. 15.

D.	♂'s Rt. Asc.	
1	5 h.	+
	m.	s.
2	40	32
3	43	30
4	46	28
5	49	26
6	52	23
7	55	21
8	58	18
9	6 h.	+
10	4	12
11	7	9
12	10	5
13	13	1
14	15	57
15	18	53
16	21	49
17	24	44
18	27	39
19	30	34
20	33	29
21	36	23
22	39	17
23	42	11
24	45	5
25	47	58
26	50	51
27	53	43
28	56	36
29	7 h.	+
30	5	10
31	8	1

D.	♂'s Declin.	
1	23° N.	53′
7	24	2
13	24	4
19	23	58
25	23	45

THE "BRITISH QUEEN."

Sir,—Where is the *British Queen now?* She was to leave New York on the 2d December, which is twenty-two days ago! Do the Scotch engines after all not answer? Were my former fears just, or was I wrong? Finally, is it true, that the *President* is also going on a cruize for engines to the North, whilst, I say it again, the *best* engines could be had close by, and can *not* be had any where else? When will my cockney neighbours get cured of their folly?

A speedy reply to these queries will oblige, dear Sir, your old correspondent and humble servant,

Bow Bells.

Cheapside, *Christmas Eve.**

PATENT LAW ADJUDICATIONS.

Court of Common Pleas, Friday, Dec. 13. *(London Sittings, before Mr. Justice Coltman and Special Juries.) Gillet and Chapman v. Gilby.*—This was an action for the infringement of a patent of Messrs. Gillet and Chapman for "certain improvements in vehicles called cabs," granted 21st Dec., 1836, which patent was for improvements on the invention of Mr. Joseph Hansom, who previously obtained a patent in 1835. The cabs, therefore, which form the subject of this action are known in the streets of London under the name of "Hansoms," and are without question the safest and easiest upon the road; hence arose numerous infringements of the patent, which it was the object of the present action to suppress.

Mr. Hill and Mr. Shee were counsel for the plaintiffs, and Mr. Ball for the defendant.

It appeared that the improvement consisted in having a seat behind for the driver, the frame of the carriage hanging on springs, the seat for the passengers being lower than the springs, German windows in front, and an odometer attached to the carriage for measuring the distance performed by it, whereby both the owner and the passenger would be protected against the driver. The defendant, who is a cab proprietor, had used cabs constructed on a similar principle to some, but not to the entire extent.

The jury returned a verdict for the plaintiffs, with nominal damages.

The learned Judge, upon the application of the plaintiffs' counsel, certified, under the new act, that the question of the validity of the patent had been tried, so as to give the plaintiffs treble costs against any future

* The "British Queen," we are happy to inform our correspondent, has arrived safely in port, after having weathered a series of more severe gales than any yet experienced by her competitors. A most flattering testimonial to her commander, Lieutenant Roberts, appeared in the Times of December 30.—Ed. M. M.

defendants against whom a verdict shall pass for an infringement of the same patent.

The Same v. Chapman.—This was an action by the same plaintiffs against the defendant as the builder of the cab used by the defendant in the last action.

The same counsel appeared for the plaintiffs, and Mr. Wheatley for the defendant.

The jury returned a similar verdict to that in the preceding case.

NOTES AND NOTICES.

Improved Marine Engines.—A fine new iron steam boat, the property of Lord F. Egerton, or in other words of the Bridgewater Trust, was recently launched from the yard of Messrs. Page and Grantham. She was named the *Alice*, after Lord Francis Egerton's eldest daughter, is about 170 tons burden, old measurement, is neatly fitted up, and is a handsome lively looking boat on the water. With the whole of her machinery, fuel, &c. on board, her draft of water is only four feet six inches. She has two engines of thirty horse power each, made by Messrs. Devonport and Grinrod, of the Caledonian Foundry in this town, upon a novel and improved construction, their peculiarity consists in the fixing of the cylinders on an angle of 45 degrees, in the form of a rectangle, with the hypothenuze at the base, so that they act as a stay and support to each other. No side levers *are required or counter balances;* and the working parts being fewer than in ordinary engines, they are less liable to derangement, and not so much exposed to *wear* and *tear.* These engines, are exceedingly compact and have realized all that was contemplated by the ingenious makers—ample power—ease in working, and great strength, combined with unusual lightness. At twelve on Saturday night several gentlemen proceeded in the vessel from the Clarence Dock on a short experimental trip on the river. New engines are necessarily stiff, and it requires some time to ascertain their proper adjustment. With all disadvantages, however, the *Alice* performed their work admirably, from the moment she left the dock. A very short trip only was intended on the first occasion; but the speed of the vessel was so satisfactory, and the gratification of all on board consequently so great, that she proceeded up the river a distance of 12 or 14 miles and back—accomplishing the trip "out and home" in about two hours. On her way up she beat several very powerful steamers, and on coming down successively headed two of the Runnora packets in gallant style. The strokes of the engine averaged thirty-two per minute, but when at her full power they will make thirty-five.—*Liverpool Standard, Dec.* 21.

The Thames Tunnel.—This work is now, it is said, carried on at the rate of eight feet per week. It is now advanced to within about 120 feet of the wharf wall on the Wapping side of the river.

Construction of Davy Lamps.—The communication from our intelligent correspondent, "Black Diamond," has excited the attention of mining engineers. Mr. Lionel Brough, of Neath, has addressed the following letter to the *Mining Journal* in reference thereto :—"I have had frequent occasion to point out to colliers the imperfection mentioned in the letter above alluded to, and only a few days since it became my duty to inspect a work—a portion of which was full of 'fire,' and not having any of my own lamps with me, I was induced to examine the one placed in my hands, and on unscrewing the gauze cylinder, and looking end-ways at its immediate connexion with the brass ring attaching it to the lamp, I there detected openings sufficiently large to allow of small shot being dropped through. This was a new lamp—and many others then examined were equally unsafe; I, therefore, as a temporary precaution, stopped up such orifices with clay, so as to enable me to perform the requisite services, and I have no hesitation in stating my firm conviction, that had I not done so, this lamp would have fired—that portion of the mine then under investigation being filled with an explosive atmosphere. Would it not be, Mr. Editor, most desirable that all lamps should be submitted to a strict examination by competent judges before they leave the workshop of the manufacturer? This is a subject where legislative enactment would, beyond all doubt, produce beneficial results; and it becomes the duty of all who are connected with mining pursuits to bring their knowledge and experience before the public, as I am quite convinced that the real 'safety' lamp of the great and talented inventor is positively what its name infers—that is, the means of safety when well and honestly manufactured, and placed in the hands of steady men accustomed to its use—in fact, nearly all investigations, both legal and otherwise, have proved that the innumerable frightful accidents that have occurred within the last twenty years have arisen from imperfection in the fabrication of the lamp, or from shameless carelessness in its use."

Edinburgh Exhibition of Arts, &c.—The exhibition in the Assembly Rooms, which was opened on Tuesday, attracts great attention, and is crowded by all ranks of society; among whom we have noticed the Duke and Duchess of Argyll, the Marquis of Lorn, Lord Altremont, Sir Thomas Dick Lauder, Colonel Douglas and the officers of the 78th Highlanders, the Rev. Mr. Bennie, President of the School of Arts. The practical illustrations are in full operation, and include a magnificent display of the application of science to art on a scale such as has never been previously witnessed in this country. The light-house reflectors and lenses, including the lime ball reflector, the reflector with coloured light, and the revolving lenses, occupy the east end of the large room, and shed a flood of the most brilliant light upon the spectator. The printing, copperplate, and lithographic presses are continually in action; and the jacquard loom, the weaving of stockings, turning of wood, modelling in clay, basket-making, paper-making, &c., present a series of processes of extreme interest to all; while the magnificent illustrations of the Polariscope, on which alone the committee have expended upwards of 50*l*., present to the man of science a treat which has not hitherto been accessible to him in this part of the island. The experimental arrangements of the Polariscope are under the superintendence of Mr. E. M. Clarke, who has arrived from London at the invitation of the committee, for this purpose. It will give some idea of the magnitude of the arrangements made for this exhibition, when we state that the value of the insurance of the various models and specimens is between forty and fifty thousand pounds. We have much pleasure in adding, that the pupils of numerous schools and academies have already visited the exhibition, and on Saturday morning (this day), we understand that upwards of 800 boys, from different charity schools, are to be admitted gratuitously.—*Edinburgh Chronicle*, Dec. 28.

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Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 857.] SATURDAY, JANUARY 11, 1840. [Price 3*d.*

Printed and Published for the Proprietor, by W. A. Robertson, No. 166, Fleet-street.

TREGELLES'S MACHINE FOR RAISING AND LOWERING MINERS.

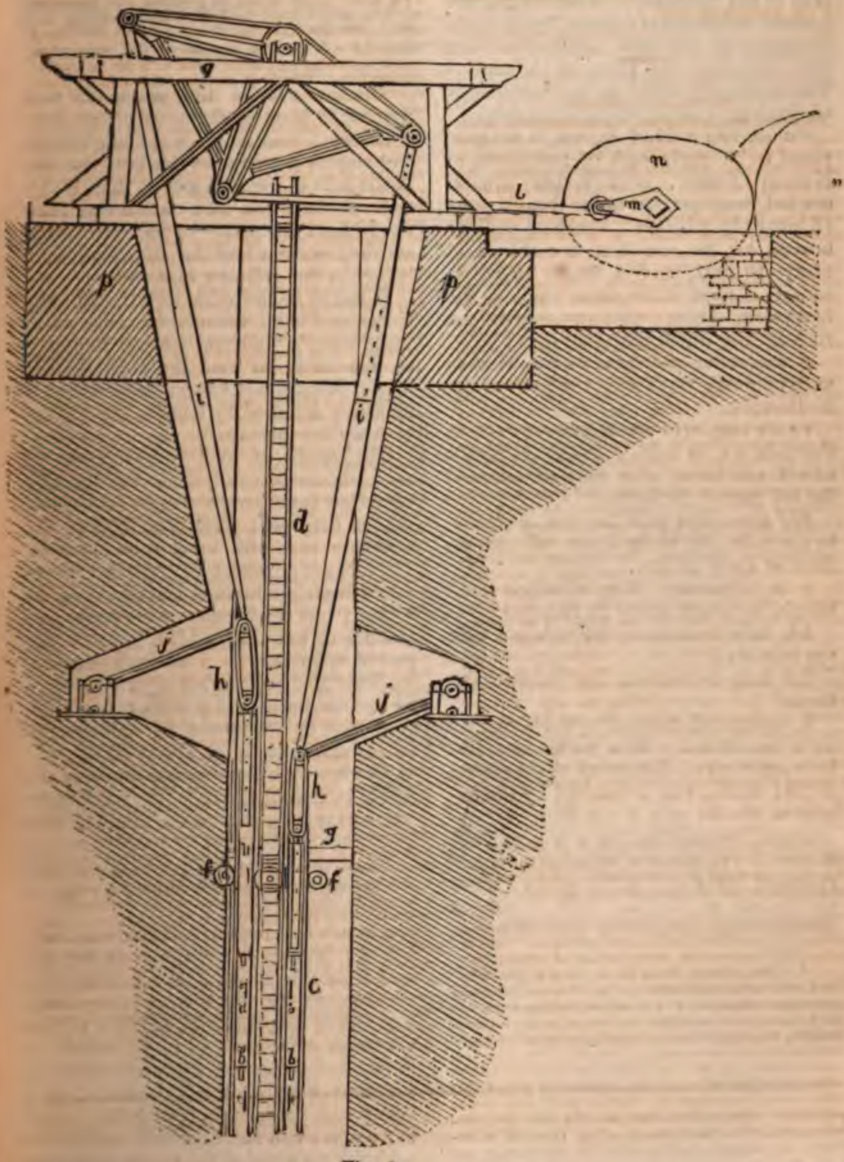


Fig. 4.

DESCRIPTION OF A PLAN FOR DESCENDING AND ASCENDING MINES. —BY E. O. TREGELLES, C.E.

[From the Sixth Report of the Cornwall Polytechnic Society.]

Figs. 1, 2, and 3, (pp. 243, 4) are a longitudinal section, a cross section, and plan of the machinery for facilitating the descent and ascent of miners, being a modification of the plan adopted in some deep mines of the Harz, in Germany.* The machinery about to be described, is adapted for a mine 200 fathoms deep.

a a are two rods of fir, which are proposed to be made each of two pieces of Norway timber, nine inches square, scarfed together, so as to form a piece 16 inches by 9 inches. Brackets or footboards, *b b*, &c., are fixed to each rod, at every 10 feet, and a rod *c*, 2½ inches square, is fixed at the outer angle of the footboard, being continuous with the rods for the whole proposed depth.

d is a ladder of ordinary kind, fixed so as to be nearly flush with the front of the footboards.

e e are staples of wrought iron, fixed to the rods *a a*, as hold-fasts for the men's hands, and being long, they are adapted for tall men or for boys.

f f f are rollers with flanches as guides to the rods; of these a set should be fixed at every 30 feet.

g is a landing place, of which there should be one at every 10 fathoms.

h h, rods to connect the rods *a a* with the beams *i i*.

j, a strap to connect the beams together.

k, sweep rod, connecting the beams *i i*, with the crank *l*. This crank is 5 feet between centres, giving to the beams a 10 feet stroke, and is worked by the engine *m*, shown only in the plan.

It will be obvious that if the crank *d*, makes 5 revolutions per minute, it will raise and lower each of the rods *a* 5 times per minute, so that at each change of stroke a short interval of time will occur, during which the brackets *b* are nearly level with each other. This interval will afford sufficient time for a man to step on to the bracket that was descending, during the time when the bracket from which he steps was ascending, then at the change of stroke, he will be raised 10 feet; and stepping to each alternate rod as they stop, he will be raised a height of 200 fathoms in 12 minutes, without fatigue.

The rod *c* is for the person to rest against, to increase the sense of security.

At every landing place the brackets *b*, and staples *e*, would be fixed on the opposite side of the rods *a a*, so that if by any accident the men fall away, they would have no further to fall, than if the accident occurred whilst mounting by a ladder in the ordinary manner.

It might be desirable to introduce the shieve and band, described in page 44 of the Society's "Second Annual Report," as a security in case the rods should break: besides this, strong catches should be firmly attached by bolts to the rods *a*, at every ten fathoms.

The weight of each rod is about 30 tons, independent of moisture, the one balancing the other; if 40 men be ascending at the same time, the load on the alternate rods will be 3 tons, moving 100 feet per minute, =672,000 lbs. raised 1 foot high per minute, the power of 20 horses; but the friction of the rods, and machinery must be added, so that the power required is a 30-inch engine, working at 8 pounds per square inch, a 6½ feet stroke, and 16 strokes per minute. A smaller engine would be sufficient if fewer men were raised at one time.

The cost of executing the whole of the work, including the rods, the machinery for working them, and the engine, may be estimated at 2,365*l*.

A less costly modification of machinery for the same purpose is shown by fig. 4, (front page.)

a a, are the rods as before described; *b b*, the brackets; *c c*, the rods for the men to lean against; *d*, the ladder; *e e*, the staples; *f f*, the rollers; *g*, the landing place; *h h*, the links to allow of the vibration of the rods *i i*; *j j*, levers to reduce the oblique strain, on the tops of the rods *a a*; *k*, is a T beam; *l*, is a sweep rod, connecting it with the crank *m*; *n n*, are two elliptic wheels connected with the fly wheel of the engine; *p*, is the masonry, to hold down the wood framing, *q*.

* The machinery of the Harz mines to which we had reference, is constructed on the reciprocating principle; their rods are much slighter than the size we suggest, and the stroke is only 4 feet 8 inches, requiring the men to change more frequently than in the arrangement proposed for the Cornish mines; as we apprehend that the risk will be diminished by reducing the number of times that the men are required to change from one rod to *another;—the guide rollers* on the German plan, *are placed at the back* and *front* of the rods *alternately; we propose having* them at the sides, but *this is an arrangement* that may be varied at discretion.

Fig. 2.

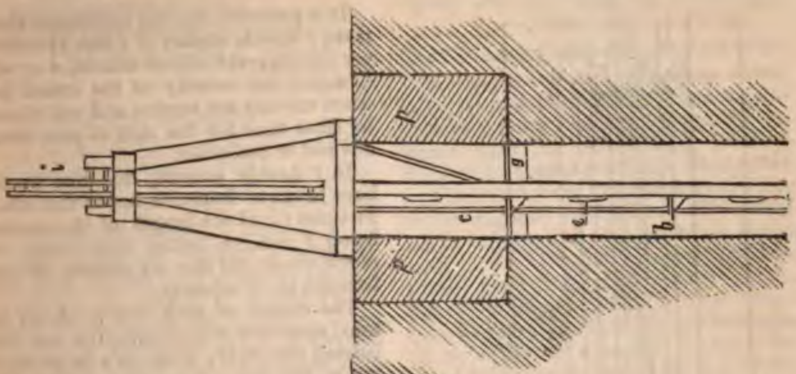
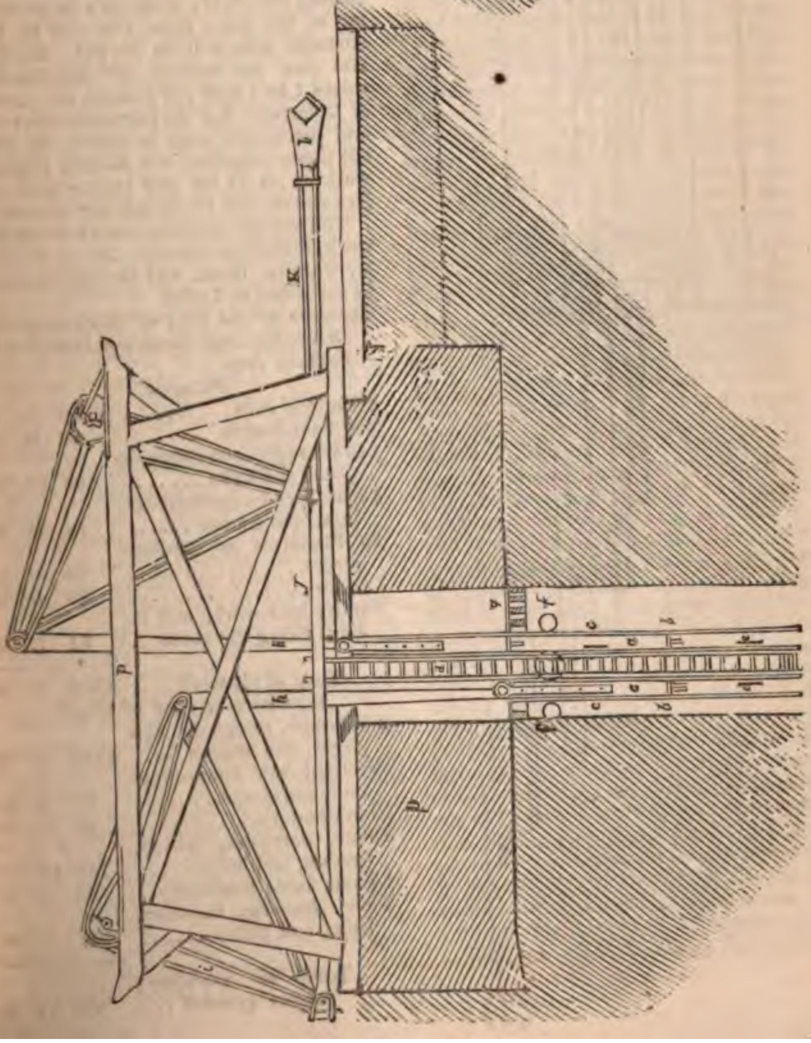


Fig. 1.



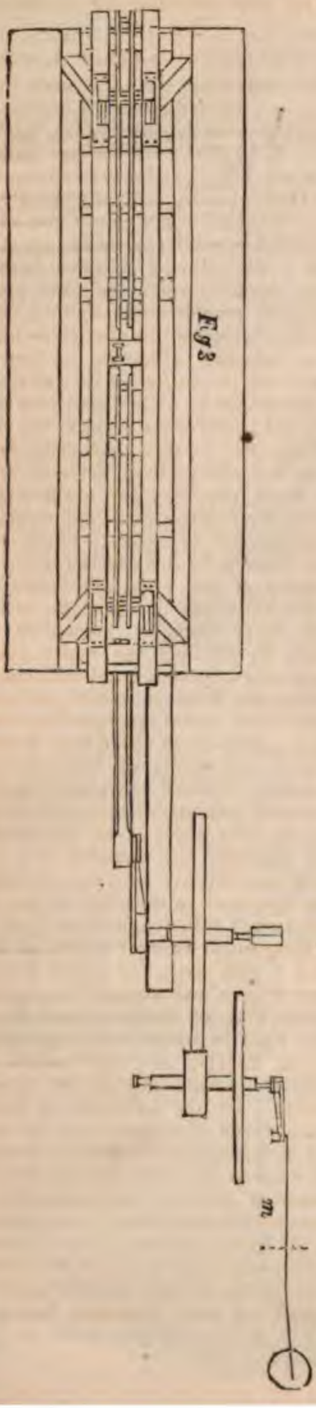


Fig 3

It is proposed that the machinery shall make 7 double strokes of 7 feet 1½ inches per minute; the elliptic wheels, *n n*, will diminish the velocity of the crank pin when turning the stroke, and will thereby allow time for the men to pass from one rod to the other.

In 7 double strokes, the men would have to move from one rod to the other 14 times; and the length of the stroke being 7 feet 1½ inches, they would be raised about 100 feet per minute, or 200 fathoms in 12 minutes.

The weight of each rod is about 30 tons, exclusive of moisture, the one balancing the other; if 20 men be ascending at the same time, the load on the alternate rods will be 30 cwt., moving 100 feet per minute, or 336,000 lbs. raised 1 foot high per minute, the power of 10 horses; but the friction of the rods and machinery must be added, so that the power required, is a 24-inch engine, working at 7½ lbs. per square inch, 6½ feet stroke, and 16 strokes per minute.

The cost of executing the whole of the work, including the rods, the machinery for working them, and the engine, may be estimated at 1,965*l.*

Estimate of the Cost of Machinery for Descending and Ascending Mines, 200 *Fathoms deep.*

Pit-work.

2 Vertical rods	£250	0	0
240 Foot-boards	10	0	0
240 Wrought-iron strapping plates and bolts........	85	10	0
120 Rollers, gudgeons, bearings, and frames	78	0	0
20 Platforms or landing-places................	50	0	0
Ladder	45	0	0
Sundry iron work, and labour fixing the above ..	81	0	0
Total of pit-work	£599	0	0

Machinery at head of Shaft.

2 V beams, gudgeons, carriages, and brasses	£256	8	0
Wrought-iron connecting-rods, and straps........	65	0	0
Crank and pin	26	16	0
Shafts, carriages, wheels, brasses, and bolts......	189	10	0
Labour fixing machinery..	50	0	0
Wood framing, masonry, bolts, and plates	217	0	0
Total of machinery above ground	804	14	0

30-inch steam-engine boiler, fly, and engine-house ..	750	0	0
Pit-work as above..	599	10	0
	2,154	4	0
Incidental expenses, 5 per cent.......	105	16	0
Engineering, 5 per cent.	105	0	0
Total cost being....	£2,365	0	0

The cost of fuel required to raise one man 200 fathoms, may be estimated thus —160 lbs. the weight of a man × 1200 feet=192,000 lbs.—say 200,000.; if the duty of the engine be taken at 15,000,000 lbs. raised 1 foot high by consuming a bushel of coal, we have the result of 1-75 part of a bushel, as the quantity of coals consumed in raising one man.

The *general charges* including wear and tear of machinery, may be estimated at 20s. per day, or 1d. per day, per man, if used by 240 men; and *the cost of coals* for descending and ascending once, at ½d. per man; therefore the general charges and the cost of coals would amount to 1½d. per day for the total cost of each man.

The expenditure of labour in descending and ascending the Cornish mines by ladders, is plainly exhibited in a note at p. 10 of the Report of the Cornwall Polytechnic Society, for 1834, to be equal on an average to one-fifth of the day; if we take the average weekly earnings of miners to 15s., we have 3s. per week as the cost of the descent and ascent of each person; whereas by the foregoing calculation, it appears, that by the apparatus, it would cost only 1½d. per day, and the time occupied may be estimated on an average at 24 minutes per day, or 1-20th of the time, which equals 9d. per week, this added to the cost, is 1s. 6d. per week on each person, and the annual saving on 10,000 men, would be 39,000*l.*

But the benefit conferred by diminishing the fatigue tending to shorten life, cannot be reduced to accurate calculation —it appears however, by an essay on this subject, laid before the Polytechnic Society at its last annual meeting, "that the occupation of the miner shortens his life, by at least twenty years," not that the whole of the injury sustained is chargeable to the descent and ascent by ladders, but it must be admitted, that a large portion is attributable to excessive fatigue, in climbing *from a great depth*, at the end *of a laborious day's work.*

LIFE AND LABOURS OF TELFORD.
NO. III.

The Chirk and Pont-y-Cysylte Aqueducts.

In conducting the Ellesmere Canal along its projected course, it became nenessary to cross the Chirk valley, through which flows the river Ceriog, forming there the boundary between Shropshire and Denbighshire, and consequently between England and Wales. This valley is 710 feet in width; the banks are steep, with a flat alluvial meadow between them, through which the river passes. After full consideration, Telford determined to overcome this obstacle by means of an aqueduct, although, to keep the canal level, the surface of its water must be maintained at 65 feet above the meadow, and 70 above the water in the river.

Previously to this time, canal aqueducts had always been made to retain the water necessary for navigation by means of puddled earth supported by masonry, and in order to obtain sufficient breadth for this superstructure, the masonry of the piers, abutments, and arches was of massive strength, and yet, after every possible precaution, the frosts, by swelling the moist puddle, often caused fissures, burst the masonry, suffered the water to escape, and sometimes threw down the aqueducts themselves; instances of which have occurred even in the works of the celebrated Brindley. Telford saw plainly that the increased pressure of the puddled earth was the chief cause of all the mischief, and therefore had recourse to a most novel and effective plan for avoiding it. The spandrels of the stone arches were constructed with longitudinal walls (as in Tongueland Bridge) instead of being filled in with earth, and across these the canal bottom was formed, by a most felicitous idea, of *cast-iron* plates at each side, fixed in square stone masonry,— having flanches on their edges, and secured by nuts and screws at every joining. By the lightness of this excellent mode of construction, the quantity of masonry is wonderfully diminished, while at the same time the iron bottom-plate forms a continuous tie, and prevents the side walls from separating by the lateral pressure of the contained water; and all danger from the action of frost or moist clay is effectually prevented, no earth whatever being used.

In every point of view the advantages of Telford's invention are immense.

The sides of the canal at this aqueduct, were made water-proof by ashler masonry, backed with hard-burnt bricks, laid in cement, on the outside of which was rubble-stone work, of a character uniform with the rest of the structure. Great facilities were afforded for the execution of the work, there being an excellent quarry of rubblestone almost upon the spot, and quarries of limestone within a trifling distance; so that the total cost of the whole stupendous undertaking but little exceeded twenty thousand pounds, and, having been well executed in all its parts, it still remains in a perfect state. In addition to its many other merits, it forms a picturesque object in a naturally picturesque situation, in that respect forming a strong contrast with many other works whose primary object has been the facilitating the operations of commerce; nor was it by many the only work of Telford which could put in a triumphant claim to this distinction. The aqueduct lies in a well-wooded valley with Chirk Castle on an eminence immediately above it, Glen-Ceriog and the Welsh mountains in the background, the village of Chirk, with Lord Dungannon's seat to the eastward, and in the space between, Ceriog Bridge and the Holyhead Road, itself a grand work of art, and another monument of Telford's skill. These combined objects compose a landscape seldom surpassed, and which never fails to call forth the admiration of the traveller in that romantic region.

But the Chirk Aqueduct, with all its claims on attention, is still surpassed by a yet more striking work of the same description in the almost immediate vicinity. The celebrated Pont-y-Cysylte is situated only about four miles further to the north, and presents a spectacle equally gratifying to the man of science and the man of taste.

The north bank of the River Dee at this site is abrupt: on the south the acclivity is more gradual, and here, on account of gravelly earth being readily procured from the adjacent bank, it was found most economical to push forward an earthen embankment, 1,500 feet in length, on the level of the waterway of the canals, until its perpendicular height became seventy-five feet; and yet a distance of more than a thousand feet intervened between this enormous mound and the northern bank, in the middle of which space flowed the River Dee, at a depth of 127 feet below the canal. It was originally proposed to lower the course of the canal by seven or eight locks on one side of this chasm, and after crossing the bottom of the valley, to raise it again to a similar height on the other side by similar means; but Telford soon became convinced that this clumsy expedient was not only unadvisable on the ground of its own demerits, but actually impracticable from the serious loss of water it would have caused on both sides of the valley, in a situation where there was barely sufficient to supply the unavoidable lockage and leakage of the summit level. He therefore determined upon an aqueduct, and from the fertile resources of his mind worked out the grand conception of the "Pont-y-Cysylte."

He had about that time carried a portion of the Shrewsbury canal by a cast-iron trough at a height of about 16 ft. from the ground, and finding this practicable, he at once rushed to the conclusion that the Ellesmere canal might be conducted in the same way, at the immense height which would be rendered necessary in the vale of the Dee! Startled as a mind of ordinary calibre might well be at so towering an idea, Telford, confident in his practical knowledge of the powers of masonry conceived that (to him at least) no very serious difficulty could occur in building a number of square pillars, of sufficient dimensions to support a cast-iron trough for the canal, and of sufficient height for the purpose required. He therefore caused a model to be made of two piers, a compartment of ribs, the iron canal trough, the towing-path and side railing, and all the flanches, nuts, screws, and joints complete. As he could rely on good foundations and excellent stone for the masonry, first-rate materials and workmanship, and a model which was quite satisfactory, at any rate to his own mind, he entered on the arduous undertaking with the utmost confidence of ultimate success, although his plan was generally considered entirely visionary, and by not a few held to be fearfully hazardous, if not absolutely impracticable.

The height of the piers above the low water in the river is 121 feet, their sec-

tional dimensions at the level of high water 20 feet by 12, and at the top 13 feet by 7 feet six inches. To the height of 70 feet from the base they are perfectly solid, but the upper 50 feet are built hollow, the outer walls being only 2 feet in thickness, with one cross inner wall. This construction, which was at this time first introduced by Telford, unites so many recommendations, that he always made use of it himself in all subsequent works, and saw his example followed by every enginer of the day. By this method, not only is the centre of gravity thrown lower in the pier, and its stability consequently promoted, but a vast quantity of masonry is saved, and that at the greatest distance from the ground, while (a most important point) sound workmanship is absolutely secured, as every side of each stone is exposed to observation, and the customary "slubbering o'er" of the interior portions thereby rendered impracticable. Another felicitous idea more particularly referring to canal construction, was that of placing the towing path on the aqueduct, where economy of space, was of course so great a desideratum, upon cast-iron pillars, instead of a mass of earth. There is thus a free passage for the water beneath, and the width of the canal, which is apparently only 7 feet 2 inches, is virtually increased to 11 feet 10 inches, the width of the towing path being 4 feet 8 inches, under which the water fluctuates and recedes freely, so that the boat passes with the utmost ease, though it may occupy the whole *apparent* breadth of the canal. This improvement is a striking evidence, if any were wanting, that none even of the minor economical details of his greatest works escaped unconsidered from the mind of Telford.

A most ingenious plan was resorted to for neutralizing the feeling of danger natural to the workmen engaged in so stupendous a construction as the Pont-y-Cysylte. All the piers were first built to the height of 20 feet; the scaffolding and gangways of the whole were then raised to that level, and, the materials being brought from the northern bank, the workmen always commenced at the most distant, or southern abutment pier, and receded regularly pier by pier to the northern bank. By thus ascending gradually throughout the whole work, they felt no more apprehension of danger when on the highest, than they had at first on the lowest gangways; one man only fell during the whole of the operation of building the lofty piers, and fixing the mass of ironwork on their summit; and this accident is said to have taken place from the man's own carelessness.

This singular structure was completed and opened in 1805, and the canal carried across it has been navigated ever since with facility and safety. The whole expense of the aqueduct, and the great embankment, was no more than 47,000*l.*, a very moderate sum compared with the lowest estimate of what the execution of the object in view would have cost by any mode in practice before the time of Telford.

The Pont-y-Cysylte is not only grand as a specimen of engineering, but as a noble piece of architecture, and, situated as it is, immediately on the line of the great road to Ireland through North Wales, and in so picturesque a site, it attracts the attention and the admiration of every passenger. So well do its twenty gigantic arches assimilate with the magnificent scenery with which they are surrounded, that the vast edifice seems as if made purposely to connect the sides of the valley in the most fitting manner, and to add an essential feature to the whole, without which the observer hardly believes the former splendid view can have seemed complete. It is equally in harmony with all around, whether viewed from near its base, where an antique bridge over the Dee, a few feet only above the surface of the river, adds new grandeur by the contrast to the giant structure which rises in the air above it,—or seen in connection with the whole extent of the lovely vale of Llangollen, from some such commanding position as the battlements of Wynnstay Castle, whence it forms an object as striking as any of the natural beauties with which the prospect abounds. We are *now* familiar with somewhat similar stupendous works, in the "viaducts" of our principal railways, but none of these can compete for an instant in appropriateness, simplicity, and magnificence, with this grand conception of Telford,—albeit the constructors of the former have had all the lights of foregone experience to aid them, and the Pont-y-Cysylte was the first work of its kind on record.

Telford, whether owing to his poetical temperament or not, appears to have had a peculiar tact in adapting his works to the scenes through which they passed, in this case some of the finest in Britain. The lover of the picturesque might tremble at the report that an engineer was about to carry a canal through the heart of North Wales, and to profane her most beautiful valleys by locks and embankments, but Telford executed the difficult task so as not only to avoid injuring the natural charms of the spots he touched upon, but absolutely to enhance their attractions in a high degree. Prince Pückler Muskaw speaks shortly, but enthusiastically of the Pont-y-Cysylte as "a work which would have done honor to the Romans in the height of their power;"—yet it was produced at the behest of a simple commercial company. Almost every tourist through Wales pays it the passing tribute of his admiration: one of the latest of these, Mr. Thomas Roscoe, thus alludes to it in his splendidly-illustrated "*Wanderings in North Wales*"—and in so doing echoes only the judgment of all his predecessors:—"As a work of magnificence and art, this splendid aqueduct is not surpassed by any structure of the kind known in modern times. It impresses the beholder with admiration of the extent of human power and skill, directed by the light of science, and executed by the combination of human energies and wealth."

It may be remarked as a singular fact, that the Ellesmere Canal is supplied with water from the celebrated Lake of Bala, which is retained (most probably to the advantage of its picturesqueness of appearance) to a greater height than it otherwise would be, to supply the summit level, in order to which a supplementary canal, or "feeder," is conducted along the heights on one side of the vale of Llangollen. Thus, as Telford himself remarked, the whole neighbourhood now presents a striking contrast in every point to its state in the olden time, when it flourished as the favourite haunt of Owain Glyndŵr and his bands; the power of commerce, joined by scientific skill has now decked the scene of feudal rapine with structures sacred to an interchange whose very soul is peace, and the once sacred waters of *the Deva, in modern* days are drawn off to spread prosperity over all the surrounding lands of the once-hated Saxons.

Taken altogether, the Pont-y-Cysylte, was perhaps, until the same vicinity witnessed still more noble undertakings,—the greatest of Telford's triumphs. That he was himself of the same opinion may be gathered from the fact, that he had both that and the Chirk Aqueduct introduced in the back ground of the portrait painted by Mr. Lane at an advanced period of his career.

ANSWER TO NAUTILUS'S ASTRONOMICAL QUESTION.

Sir,—I send you an answer to the "Astronomical Question," proposed by "Nautilus," in No. 853 of your scientific journal.

I remain, Sir, &c.

JOHN NELSON.

Paddington-street, Jan. 4, 1840.

1st. Let us suppose the latitudes of both places to be north, and that the sun's declination is also north. If the latitudes of the two places are equal, and consequently their longitudes unequal: in this case, the length of the same day at both places would be equal, but the times would be different; therefore, the sun could neither rise nor set to both places simultaneously on the same day. 2ndly. If their latitudes were unequal (both north, and declination north), and their longitudes equal or unequal, the length of the day at that place which has the higher latitude would be longer than that of the other; in this case, the sun could not rise and set simultaneously to both places on the same day. 3rd. If the sun's declination is south (latitudes still north), then if their latitudes were equal, and, consequently, their longitudes unequal, then the length of the same day at both places could not be of the same duration; for, in this case, the place that has the lower latitude would have the longer day. The required event cannot take place on this supposition; therefore, the two required places cannot be both in north latitude, whether the declination is north or south; for the same reason, the event will not take place the same day when both places are in south latitude, whether the sun has north or south declination. 4th. Suppose the latitude of one of the places to

be north and the other south, then, if the declination is north, the length of the day in that place which has north latitude will be longer than that of the same day to the place that has south latitude, whatever their longitudes may be; and if the sun's declination is south, the contrary will be the case, so that here again, according to this last supposition, the event cannot take place; it therefore follows, that when the sun has either *north* or *south* declination, there cannot be two places on the earth that will satisfy the conditions of the question. Lastly, when the sun has neither north nor south declination, that is, when the sun is in either of the equinoctial points, then on these two days, in every place from pole to pole, the length of the day will be 12 hours, or the sun will rise at 6 A.M. and set at 6 P.M.; consequently, any two places that have the same longitude, the sun will rise and set simultaneously on the same two days, viz., March 20th, and September 23d.

Here, however, it may be noticed, that in this last supposition the sun's declination for 12 hours is supposed constant; this, however, is not strictly true, as the change of declination at these two periods, for 12 hours, will be nearly 12 minutes of a degree; but to any two places in the same longitude, and not from the equator where the change of declination produces very little difference in the length of the day, the event, to all intents and purposes, will take place.

J. NELSON.

ON CHEAP PHILOSOPHICAL APPARATUS.

Sir,—It has often occurred to me, when attending Lectures on Natural Philosophy at Mechanics' Institutions, that if there had been present any needy men of talent, whose latent mental capacity might by such means be stimulated to prosecute experimental science, they would in all probability not venture to do so, owing to the expensive apparatus used on such occasions. The slight pleasure they experienced at the new sources of intellectual relaxation thus unfolded to them, would be succeeded by a depression of spirits and corresponding gloom, arising from the painful recollection that their poverty was too great to give them a chance of purchasing similar apparatus, and they would feel so much more discontented with their lot, by the fact, that their straightened means not only abridged their social and domestic comforts, but also crushed their intellectual aspirations.

The object, then, of this communication, is to give consolation and hope "to those who toil," and to assure them that they need not be prevented pursuing experimental science by the great cost of apparatus, as I shall detail plans in some future contributions, for every man being "his own instrument maker," and this they can accomplish at such moderate prices, that the poorest may be able to spare the money.

Before entering into any particulars on this subject (which has occupied my attention more or less for years), I will tell you what has induced me to address you at the present time. During a recent visit at Manchester, I was introduced to a gentleman of the name of Peacock, who had been very instrumental in forming the Salford and other Lyceums in the neighbourhood townships. I asked him why they were not called Mechanics' Institutions, or in what they differed from them? He told me that the yearly subscriptions usually charged at Mechanics' Institutions can only be paid by the middle classes, and that the poorer classes, consisting of working mechanics, weavers, labourers, and handicraft men of various kinds, were in consequence excluded on account of the terms. It was, therefore, suggested to some friends of education, that societies for the diffusion of knowledge might be formed to suit the intellectual wants and the pecuniary means of the latter kind of persons; hence arose the Lyceums. The charge for membership at the latter institutions are about 1s. 6d. or 2s. a quarter, which includes the privilege of attending the lectures.

The lecturers are in many instances gentlemen of high reputation, who have been engaged at the other institutions,* and whose services are secured for these humbler seminaries of science at such terms as could not be offered to them, unless they had had engagements which remunerated them for their time.

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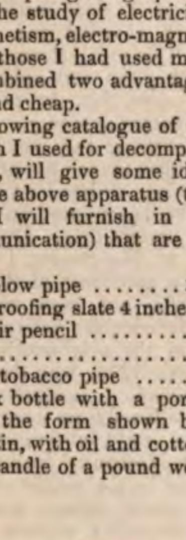
* Philosophical Society, Athenæum, Manchester Mechanics' Institution, &c. &c.

Reflecting on this benevolent scheme, I was reminded of the plans hinted above, and of my own difficulties in studying some of the experimental sciences (as there were not any Mechanics' Institutions in my early days), and considering the great advantages which must result from the present mode of teaching natural philosophy, if the apparatus could be procured at such a price, that every man might have them, I have determined upon getting up some apparatus for the study of electricity, galvanism, magnetism, electro-magnetism, &c. similar to those I had used myself, and which combined two advantages, being portable and cheap.

The following catalogue of the apparatus which I used for decomposing metallic salts, will give some idea of the price of the above apparatus (the details of which I will furnish in some future communication) that are spoken of above.

Common blow pipe	3d. or 4d.
A piece of roofing slate 4 inches by 3	( )
Camel's hair pencil	½d.
Borax	1d.
Clean clay tobacco pipe	¼d.
A small ink bottle with a portable tube of the form shown below made of tin, with oil and cotton; a a large candle of a pound weight	4½d.
	10¼d.



The slate is used to rub or grind the borax with water into a creamy consistence; it is also used to attach a piece of any sulphate or carbonate of any metallic salt to the tobacco pipe, which, being a bad conductor of heat, presents many advantages over charcoal. One of the most obvious is the opportunity which the operator possesses of observing all the changes the salt undergoes, prior to its conversion into the metallic form. The process is very simple; the borax being first gradually dried is afterwards vitrified, and the portion of metallic salt is affixed to the pipe, after which the heat can be increased to a great intensity (the point of the flame), and the operation continued for a long time.

With your permission I will resume the subject at my earliest convenience, and with great respect,

I am, Sir, yours, &c.,

J. L. LEVISON.*

Hallgate, Doncaster, January 1, 1840.

P. S.—If the committees of Lyceums would procure materials, glass tubes, zinc, copper, &c., and chemicals, and supply the students at a moderate rate, they would procure their apparatus so much the cheaper. J. L. L.

IMPROVED POLE-LATHE CHUCK.

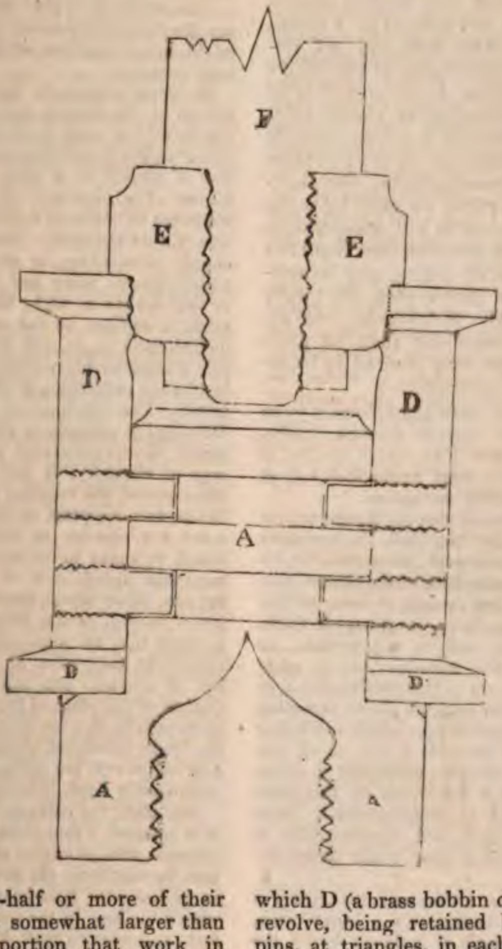
Sir,—In reference to the pole-lathe, it has been asserted that "it is impossible to turn any delicate work, or that which is required to be hollow. Even to turn a disk by means of the centre, or pole-lathe, is difficult, if not impossible." Wherefore I now submit an invention, of which I am the author, for the use of such of your readers as may require it, and court their opinion thereof. My object is to obviate the impossibility and difficulty of turning in general, by means of the pole-lathe, and flatter myself that I have succeeded.

The annexed sketch is the simile of my *pole-lathe chuck*. To me its use is solely applicable to a newly-invented *spiral turning apparatus*, of which I am also the author. To others I doubt not its efficacy for general purposes.

It is applicable as a *screw-chuck*, *driving-chuck*, and *strut-chuck*, and may in some instances supersede the collar and mandril of the foot lathe, viz.: Presuming a circle of thirty or forty inches required turning. Lathes generally are inconvenient for the purpose, excepting those with sliding beds, which are very few in number. Secure the puppet of any lathe, reversed, that is of sufficient strength, to the foot of the beds; screw

* We shall be most happy to receive Mr. Levison's communications.—ED. M. M.

A to a shoulder on the puppet screw, and if required a nut may be used to insure the steadiment of the screw; D may then be attached, or otherwise, by means of the brass pins introduced through it into the two grooves of A. These have



a screw on one-half or more of their length, which is somewhat larger than the remaining portion that work in the grooves, which must be accurately turned.

Thus a collar and mandril is formed. Now remove the strut from the chuck E, and fill the vacancy with a screw made for the purpose, and it is ready for work when connected with a fly-wheel, or other power.

Reference to the Sketch.—A is of wrought steel, square or octagon at the shoulder B; C a round shoulder against which D (a brass bobbin or pulley) must revolve, being retained by three brass pins, at triangles, in each groove; E a brass chuck, screwing in or out of D at pleasure; F an iron strut, screwing in or out of E in like manner, having a small nut on the end of screw for security. E being entirely removed, a driving chuck may be attached to D, and the latter worked by a foot-lathe, or pole-lathe motion.

Yours respectfully,

R. L. PACKER.

HALL'S REEFING PADDLES.

We presume that the following notice of a new invention of Mr. Samuel Hall's, and which we extract from the *United Service Journal* for the present month, has reference to the subject of a patent lately obtained (Oct. 7th) and yet unspecified. The description of Mr. Hall's reefing paddle wheel, however, and of its anticipated advantages, so closely coincides with that which we have already published in reference to the invention of our talented correspondent, Mr. Holebrook, that we think we shall be doing Mr. Hall a service to call his attention to the articles in question (see Nos. 812 and 836). We, of course, may be mistaken, and Mr. Hall's plan be totally different from Mr. Holebrook's;—if so, we rejoice, as there will then be more likelihood of the evils desired to be remedied, being overcome:—

"We now turn with great pleasure to an invention of the highest promise, which, when brought into play, which we trust it will be very soon, must accomplish a great desideratum in steam navigation.

"The invention alluded to, though not yet made public, is by Mr. Hall, the ingenious deviser of the condenser which goes by his name. By a contrivance of the utmost simplicity, all the float-boards of both paddle-wheels of a steam-boat, or either of them, can, at any time, and in any weather, be 'reefed' in a few minutes; or, in other words, the diameter of the paddle-wheels be reduced from their extreme size to any other diameter. The advantages which will follow this contrivance are well known to all persons who have attended personally to steam navigation; but a few words on this point will perhaps not be unacceptable to those who may not have had opportunities of studying the subject afloat under varied circumstances.

Every one can understand that, when a steam-vessel is loaded with a heavy cargo, or has a full supply of coals on board, the paddle-wheels will be sunk to an inconvenient depth in the water, and that, in order to enable them to work with advantage, the float boards, require to be unscrewed, and shifted nearer to the centre of the paddle-wheel—an operation of some trouble, and often requiring much time. This adjustment may, of course, be made at the beginning of a voyage, according to the draught of water, but it may become fully as necessary to shift the paddle-boards during the voyage, either *farther out or farther in.* If the vessel, for *instance, by the expenditure* of her coals, becomes lighter, the float-boards should be moved out; or, if a gale comes on a-head, they have to be moved in; which operations, if they have to be done in bad weather, are both tedious and difficult. So that any invention which shall give the power of shifting the float-boards easily and quietly must be of great practical utility, especially on long voyages.

It is well known to those who have attended to the subject that no steam-vessel can be said to work to the full extent of her power unless her engines make a given number of strokes in a given time,—say in a minute; the elasticity of the steam being supposed to continue uniformly of a certain determinate strength. Now, occasions constantly arise when, in consequence of the paddle-wheels being too deeply immersed, or that the sea is high, the float-boards are made to impinge on the surface at such an unfavourable angle, and again on leaving it, that a considerable portion of the power is lost in the production of what is called back-water. The consequence is, that the paddle-wheel is virtually so overloaded, that the steam, though generated of the proper degree of elasticity, is not adequate to turn them round the required number of times. When this happens, as the engine does not make the number of strokes per minute which it ought to do when working at its maximum speed, one of two things must happen, either steam must be blown off and power wasted, or the fires must be lowered in order that no more steam may be generated than the engine, at its reduced number of strokes, can consume. In consequence of this state of things it happens not unfrequently that vessels whose paddles are too deeply immersed, though carrying a high nominal power, are obliged to work with a power really much inferior.

Mr. Hall, the patentee of this invention, is of opinion "that if the *British Queen*, for instance, with an engine of 500-horse power, were to start from the River so deeply laden as to bring the float-boards of her paddle-wheels too low in the water, by six or eight feet, and were to meet with a hard gale and a high sea, such as to resist the rotatory action of the paddle-wheels to the extent of one-half, or, in other words, to reduce the number of strokes of her engine from 20 to 10, she might, to all practical purposes, be called, for the time being, a steam-vessel of only 250-horse power, instead of 500! Things being in this predicament," he conceives "that if the ship in question had the power of contracting the diameter of her paddle-wheels, and so to lessen their tendency to produce back-water to such a degree that they should make 20, instead of

10, revolutions in a minute, with the full elasticity of steam, then," as we understand the matter, "the engines would be doing their duty, and the vessel become again strictly one of 500-horse power. In the first case, that is, when the paddle-wheels were so much immersed in the water as to make only ten revolutions in a minute, it is clear that no more than ten cylindersfull of steam, of a given elasticity, are expended in a minute in propelling the ship; whereas, in the case of the reefed paddle-wheel, twenty cylinders-full of steam, of the same elasticity, are employed in the same interval of time in propelling her; provided, at the same time that this additional velocity is obtained, that there be enough surface of paddle left in the water to resist the elastic force of the steam, and to cause the proper reaction."

We do not quite go this length; but we are sure that the difficulty and loss of time of reefing the paddles has hitherto been so great (at times it is impossible), that vessels have often put back from not being able to employ, to the most efficient purpose, the power which the ship actually possesses on board, but which, from defective arrangements in this particular, they have been obliged to relinquish.

Mr. Hall's contrivance, by giving the complete and ready command over this important adjustment, at all times and seasons, will, we conceive, effect a great improvement in the practice of steam navigation, especially in boisterous weather. In war-steamers, and in all others which make long voyages, it may often be highly useful to have the power of working with the sails alone, and as this can be done effectually only by removing the float-boards, Mr. Hall's invention will then come into play. In a short time the principle of this valuable invention will be generally known, when we are confident it will gain the admiration of every one who knows how to value the highest order of ingenuity, applied in the simplest, most efficient, and economical form, to correct a serious practical inconvenience.

WAPSHARE'S PATENT STEAM LAUNDRY.

The *Oxford Herald* gives the following description of an ingenious application of steam power, by which, in the Oxford Union Workhouse, the whole of the clothing and other articles used in it are washed, dried, and ironed in an almost incredible short space of time. No less than 1,235 articles of apparel, bed clothes, &c., were washed, dried, and *ironed in two days, with the assistance of only eight women and two girls from the school.* This unique and elegant machine is the invention of James Wapshare, Esq., of Bath, for which we understand he has obtained a patent. The apparatus consists of a small steam boiler, with two pipes for the conveyance of steam. By the one pipe the steam is conducted to the coppers used for boiling the clothes, and supplying the washers with hot water; by the other the steam is carried to a closet or large box, in which the linen is to be dried. The exterior of this box is a wooden frame, covered with zinc; within it is fitted up with pipes, increasing in number, according to the extent of drying power required. These pipes are arranged horizontally, one above another, connected at one end by a bend or turn, thus forming a continued duct for the steam. The steam is admitted at the upper pipe, and passes its condensed water at the lowest. On either side of this tier of pipes is a moveable clothes-horse, which is drawn out to be hung with clothes. These horses are made close at the top of the box, so that no heat may escape over them, and the clothes are so disposed on them as to form an entire sheet, completely enclosing, and preventing any escape of the heat radiating from the pipes, by passing through the articles to be dried. This deposition of the clothes is easily accomplished, but difficult of description. On the outside of the horses, or on that side which is not next the pipe, a valve or opening is made on the top of the box, and a current of air being admitted at the bottom, the steam or moist air derived from the clothes as they dry, is carried off as fast as it is generated. One set of these pipes, with two horses, would be sufficient for any moderate family. In an establishment so extensive as a Union Poor House more is required. In the closet or box erected are three ranges of pipes, and consequently six horses, or two to each range, having an air space, with its valve between each set of horses. Attached to the flue that surrounds the boiler is a small oven for heating the irons, so that the whole operation of the laundry, as far as heat is required, is simultaneously effected by one fire.

KING'S COLLEGE, LONDON.—DEPARTMENT OF CIVIL ENGINEERING AND SCIENCE APPLIED TO THE ARTS AND MANUFACTURES.

Regulations in respect to Certificates.

1. The certificates of the second and third years will be of two forms—ordinary certificates, and certificates of honour.

2. No certificate, whether ordinary or of honour, will be granted, which, among the signatures affixed to it, does not include those of the professors of mathematics, mechanics, and chemistry.

3. A certificate of the second year will be necessary to obtaining one in the third.

4. Any student to whom a certificate shall have been refused at the Midsummer examination of any year, may apply for it at the examination of the following Christmas.

5. Every student desirous of obtaining a certificate in science, applied to the arts and manufactures, will be required to present to the examiners the detailed description of some process of manufacturing art, accompanied by the drawings necessary to the explanation of it. This exercise is to bear a certificate of approval from the lecturer on manufacturing art and machinery; and the subject of it is to be appointed by him at least three months before the day of examination.

The certificate of honour will be granted only when this exercise shall have been approved by the lecturer, as the exercise of a candidate for that certificate.

6. Every student applying for a certificate in civil engineering, whether of the first or second years, will be required to present to the examiners finished drawings of the plan, elevation, and section of a machine, made under the eye of the teacher of drawing, and bearing his certificate of approval.

For the certificate of the third year these drawings are to be accompanied by others, showing the details of the machine, drawn in isometrical projection, or in common perspective.

For the certificate of honour in the third year, each candidate will be required to produce, in addition to the above, the geometrical constructions of at least six problems in descriptive geometry.

1. On the intersections of surfaces.
2. On tangent planes.
3. On developable surfaces.
4. On projections of the circles of the sphere.

7. The diploma of associate in the department of civil engineering and science applied to the arts and manufactures will be granted to such students only as shall have received the certificate of the third year.

8. Only such students as may have received certificates of honour in the third year will be admitted candidates for the diploma of associate of the first class.

9. The examination for the diploma of associate of the first class will be held at the Christmas which follows the examination of the third year. Every candidate for the diploma of associate of the first class will be required to present to the examiners, in writing, on the day of examination, the original project of some public work or mechanical contrivance or process of manufacturing art, accompanied by the calculations, drawings, and descriptions necessary to its actual execution, to be specially approved by the lecturer on mechanical art and machinery as the exercise of a candidate for the diploma of associate of the first class, and to bear his certificate to that effect.

THE PENNY POSTAGE.

The Penny Postage system is now in full operation, the Lords of the Treasury having appointed yesterday (Friday, 10th,) for the commencement of the entire reduction, so that an half-ounce letter may now be despatched from the Land's End to John-o'-Groat's for the same small sum as that charged for a note to a neighbour in the next street. The government certainly deserve every credit for the straightforwardness and alacrity manifested in bringing so great a change into operation. When once the measure had been determined on, there was assuredly no time lost in reducing the idea to practice; thus, for instance, the full reduction has been effected at once, without waiting for the preparation of the stamps that are to be used to distinguish post-paid letters when the plan is quite perfected, and which will enable the sender of a letter to free it to its destination without troubling the post-office keeper or himself with a money payment. It will be remembered, that the Lords of the Treasury offered a reward of 200 guineas for the best plan for carrying the Penny Postage into effect: it now appears that no one of the numerous plans sent is such as to justify its exclusive adoption. Their lordships have, therefore, preferred to distribute four premiums of 100*l*. each to the proposers of the four best plans, and we are happy to say that one of the successful competitors on the occasion is a gentleman whose talents and ingenuity are well known to the readers of the *Mechanics' Magazine*—our valued correspondent, Mr. Benjamin Cheverton.

MR. JONES'S CLINOMETER.

Sir,—In perusing the last number of your valuable Journal (of which I am a subscriber), I observed the sketch of an instrument called a "Clinometer," for ascertaining the description of soil at various depths, without the trouble of digging a pit, or boring, &c.

Unfortunately for the inventor the instrument is not new, as I have used *precisely* the same as the one described, eighteen months since, in Berlin, and it has been known there for years past.*

* This does not detract from Mr. Jones's merit as an original, though he be not perhaps *first* inventor.—ED. M. M.

I found it of great use in ascertaining at what depth sand sufficiently firm to build upon was to be found, as the soil of Berlin is chiefly composed of sand of various descriptions.

I remain, Sir, yours obediently,

F. J. EVANS.

Gas Works, Horseferry-road, Jan. 7, 1840.

NOTES AND NOTICES.

Flax Spinning at Amiens.—There is, at present, a joint-stock flax-spinning company at Amiens, at the head of the management of which was the late John Maberley, Esq., whose salary was 1000*l.* per annum and the engagement for twenty-one years. Before his death, he had completed arrangements with an eminent flax-machine maker, in Manchester, to make the whole machinery on the spot, he (Mr. M.) being resolved that not a single machine should be imported from England. Mr. M.'s hatred to this country was known to be extreme. The master mechanist's agreement is a most beneficial one; for instance, if a machine cost, say 100*l.* at Leeds, and the carriage and commission 15 per cent., and the insurance against smuggling 30 per cent., then the price paid for the machine, at Amiens, was to be 145*l.*, or 50 per cent. above the English price. The number of spindles are understood to be 25,000. The two engines are by Mr. Fairbairn, of Manchester, and of eighty horses each. Another flax mill of equal magnitude was commenced at the same place in 1838, and is now fast progressing.—*Sheffield Iris.*

To Crystallise Tin.—One spoonful muriatic acid, one nitric acid, eight water. Mix. Warm a piece of block tin over the fire, and rub it with a cloth dipped in the mixture. Ornament with coloured varnish.—*Mining Journal.*

"*Norwich a Port,*" *a Failure.*—The experiment of restoring Norwich to its ancient situation as a port, by making the River Yare navigable for sea-borne vessels, does not seem to have been attended with the success merited by an undertaking so boldly projected and spiritedly executed. The whole of the works are now advertised for sale, not by the proprietors, but by government, under the powers of an Act for securing monies advanced for public works, by virtue of whose provisions the whole of the navigation has become forfeited for default of payment of interest. It appears from the particulars that the whole of the tolls on vessels navigating both the Yare and Mersey, the latter of which is available for vessels of 60 tons as high as Beccles, amount to little more than a thousand pounds per annum. The speculation must therefore have turned out a grievous failure, in spite of the flattering prognostics of success which attended its earlier stages.

Definition of a Mine.—A question has been raised, which will form subject for discussion in a court of law, as to the construction put upon the word "Mine," as applied to under ground operations; it being contended on the part of some parties that the term "mine" is only applicable to mineral deposits, but which, we believe, has been already overruled—a "mine" being, in a legal sense, construed as applying to any excavation or underground operation, which may partake of workings carried on in a "miner-like manner." Hence, a quarry, although not yielding mineral produce, will be construed as coming under the denomination of a "mine," that is, where levels are driven, drifts carried shafts or pits sunk, or machinery employed to either of the appliances whereby the material is obtained—such being the legal construction put upon a "mine." We are not prepared to say whether a quarry, worked open-cast, would come under this definition: our opinion is, decidedly not—but when worked by level, either on the bed or at a depth to intersect the same at a certain distance, or by shafts, no question, we consider, can arise but that the working is that of a "mine." As the matter will, in all probability, form subject, as we have already observed, for legal discussion and opinion, we shall await the result, when we may have to say something more, with references to cases already determined. In the interim we invite the attention of our correspondents.—*Mining Journal.*

New Overshot Water-Wheel.—The great overshot wheel, erected by the Kilgetty Colliery Company, at Merrixton, near King's Moor, Pembrokeshire, was set to work on Saturday the 7th ult., in the presence of a large assembly of the ladies and gentlemen in the neighbourhood. This wheel, we believe, is the most powerful in the principality, being of 75-horse power; the diameter is forty-feet, and it is seven feet wide on the breast, and the buckets hold water more than one-third of the circumference. It is fixed in a manner that is quite novel in this country, the wheel being so closely shut in by finely-executed masonry, that the escape of water, without going to the buckets, is impossible. It works by eccentrics, giving a horizontal motion to the cranks, being the first application of this mechanical arrangement to such a purpose. It is adapted to work two pumps, giving twelve strokes a minute to each pump. The water is diverted from the stream about two miles from the wheel, and it is brought to it across the valley by an aqueduct, extending 300 feet in length, and from thirty to forty feet high. The wheel will supersede the use of steam power in the colliery, and it is contrived that, in time of drought, the water to be raised by the wheel will assist to drive it. The whole arrangements of the wheel are new applications of mechanism, and great improvements on plans hitherto in use. Considerable attention has been given to these works by parties who are not interested in them; and in the immediate neighbourhood, where so much enterprise at the present moment is in active operation in mineral undertakings, they well deserve the attention of all parties engaged in such enterprises. The works are close to the new road leading to Hobbs' Point, and may be conveniently inspected by parties travelling that way. The wheel and machinery were designed and executed by Mr. Thomas Dyson, of Downham, in Norfolk, where the wheel was made, and he has personally superintended the execution of the whole work. Although the wheel was made in order to drain the mine by pumps, it is understood the parties have since been advised to try instead the patent hydraulic belt, and intend to adopt it. A model was exhibited, and excited much surprise at the simplicity of the effective mode to raise water it had on a small scale.—*Cambrian.*

Gates for the Crossings of Railways.—Mr. T. Lambert of Stockton-upon-Tees, has constructed a neat mode for gates, to be used at the crossings of railways. The gates turn on centres; and are so simple and complete, that one man can open both of them at one time with the greatest facility. When open, they prevent any one passing on the railway, and admit the progress of carriages, carts, etc., on both sides of the turnpike. Each gate is also furnished with an elevated circular signal, containing a lamp, which turns with the gate, so that whether it be night or day, persons at a great distance will be enabled to see when "danger" is announced. We have had the pleasure of examining the model, and can say with truth, that the invention seems to effect every thing necessary for the protection of life and property at crossings, while it allows the greatest facility for passing on the road.—*Sunderland Herald.*

Leather Electrical Machine.—The Rev. Theo. Dury, under date of December 17, 1838, at Keighly Rectory, Yorkshire, England, communicates the following fact to Dr Faraday. He speaks of what he calls an extraordinary electrifying machine, which is no other than a leather strap which connects two drums in a large worsted mill in the town

of Keighly. "The dimensions and particulars of the strap are as follows:—It is in length, 24 feet; breadth, 6 inches; thickness, ⅛ inch; it makes 100 revolutions in a minute. The drums, over which it passes at both ends, are 2 feet in diameter, made of wood, fastened to iron hoops, and turning on iron axles; these drums are placed at ten feet distance from each other, and the strap crosses in the middle between the drums, where there is some friction; the strap forming a figure of eight. There is no metal in connection with the strap, but it is oiled. If you present your knuckle to the strap above the point of crossing, brushes of electrical light are given of in abundance; and when the points of a prime conductor are held near the strap, most pungent sparks are given off to a knuckle at about two inches. "I charged," says Mr. D. "a Leyden jar of considerable size in a few seconds by presenting it to the prime conductor. The gentleman who told me of this curious strap has frequently charged his electrical battery in a very short time from it; and he informed me, that it is always the same, generating electricity from morning to night, without any abatement or alteration. If this strap had the advantage of silk flaps and a little amalgam, it would rival the machine in the lecture room in Albemarle-street.—*Silliman's American Journal of Science and Arts.*

Daguerreotype.—At the last sitting of the Academy of Sciences, M. Arago announced an important improvement in the process of the Daguerreotype. Hitherto it has been necessary, in order to give the gold-coloured coat of iodine to the silvered plate, to expose it for some length of time to the vapour of iodine in a box, in which the chemical substance was placed. By the new mode, instead of placing the iodine in the box, a plate is first impregnated with the vapour, and this is placed in a flat box within half an inch of the plate on which the drawing is to be taken. The box is then shut, and in two minutes the silvered plate has acquired the proper tint. M. Daguerre hopes soon to simplify the process of the mercurial vapour after the drawing in an equally satisfactory manner.—*Galignani's Messenger.*

Microscopic Institution.—Our scientific readers will be glad to hear that a meeting took place on Friday, the 20th ult., for the purpose of forming a Society for the Promotion of Microscopical Investigations, the introduction and improvement of the microscope as a scientific instrument, the reading and discussion of papers on new and interesting subjects of microscopical enquiry, the formation of a collection of rare and valuable microscopical objects, and a library of reference. The establishing of such a society has been long under consideration, and in September last a provisional committee was appointed to prepare an outline of a constitution. The meeting was numerously attended, Professor Owen, who was in the chair, was elected president; N. B. Ward, Esq., treasurer; and Dr. A. Farre, secretary. The constitution prepared by the provisional committee was unanimously adopted, and, at the close of the meeting, the president announced that more than fifty gentlemen had enrolled their names as members, and that the future meetings would be held at the rooms of the Horticultural Society.—*Athenæum.*

Photography in India.—Photogenic drawing has been introduced into India, where it has attracted much attention, and where, certainly, so far as the action of the sun is concerned, there must be every facility for its execution. An improvement on M. Daguerre's practice has been invented at Calcutta by a Dr. O'Shaughnessy, who, instead of nitrate of silver, makes use of a still more costly material,—a solution of gold, by the aid of which he professes to be able to produce drawings very brilliantly coloured, especially in shades of red, in purple, and even in green, which has hitherto been unattainable in Europe. The Doctor also avails himself of a lens which is said to impart all the effects of light and shade to the pictures produced. If one half of the Doctor's presumed success be real, his improvements well deserve, and will no doubt soon receive, the honours of importation.

Institutions of Liverpool.—A second Mechanics' Institution has recently been founded at Liverpool, for the benefit of the numerous bodies of working men inhabiting the northern divisions of the town, who, although Liverpool is not yet quite so large as London, found themselves too far distant from the already-existing institution to partake with facility of its advantages. The new establishment appears to be very spiritedly supported, and several courses of lectures (on scientific subjects, too,) have already been delivered. The "Mechanics' and Apprentices' Library" continues also on the increase, in the number of its books as well as members. Many valuable donations have just been made to its shelves—among others a complete set of the "Naval Chronicle," a work which, although not so indispensable as some to peaceful "mechanics and apprentices" on land, is yet well worthy of a place in any general collection.

Steam Communication with India.—Much dissatisfaction has been created by the irregular manner in which the mails have been carried from India to Egypt by the East India Company, who take off the steamers from the line to serve any purpose of the moment, and regard the main object as secondary only to those of the company. The inhabitants of Calcutta have consequently held a public meeting to carry the object more completely into effect; but unfortunately, though the conduct of the company is reprobated on all hands, the dissatisfied seem to have split into two opposing bodies, so as most probably to neutralize each other's efforts. One party is for supporting the company which has been formed in London, for establishing steamers by the Red Sea line, with Mr. Timothy Curtis at its head; the other proposes to raise a subscription at once, and build at least one vessel with Indian funds alone. It is much feared that, unless the two parties come to a compromise, the general cause will be injured rather than benefited, and that the service as performed by the East India Company will become more irregular than ever.

Gypsography.—This is the new title bestowed on the process patented by Messrs. Woone and Co., and heretofore styled metallic relief engraving. The name is derived from the "gypsum," or plaster of Paris, used in the first instance in the production of the design from which the cast for printing is made. The patentees have opened an establishment at Edinburgh, and announced their readiness to execute orders, and a musical work has actually been commenced, from gypsographic plates. The process appears to answer well for this style of work, but that, of course, affords no test of its capabilities for rivalling wood engraving in the higher branches of the art.

Errata in Mr. Holebrook's "Remarks on Mr. Rennie's Comparative Experiments on Propellers," inserted in No. 856:—In line 8, col. 2, of page 227, *above* is inserted instead of *alone*. At the end of the same page should be added the following words—*effected, without increasing the quantity of the area of floats immersed.* In line 4, column 1, of page 229, *supposes* should have been *suppose.* In line 16, from bottom of column 2, of same page, instead of *wheels*, it should be *wheel.* And in line 26, from bottom of column 1, of page 231, *wheels* should be read for *wheel.*

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PARKIN'S IMPROVEMENTS IN WOODEN PAVING.

Fig. 1.

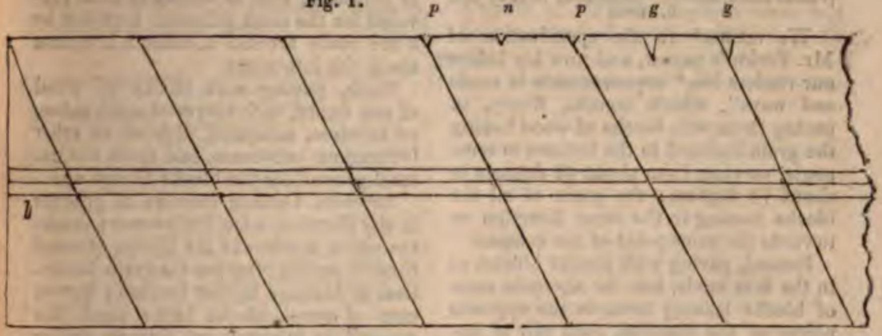


Fig 2

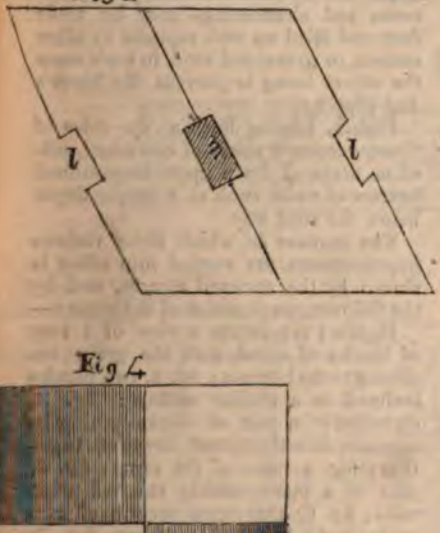


Fig 8

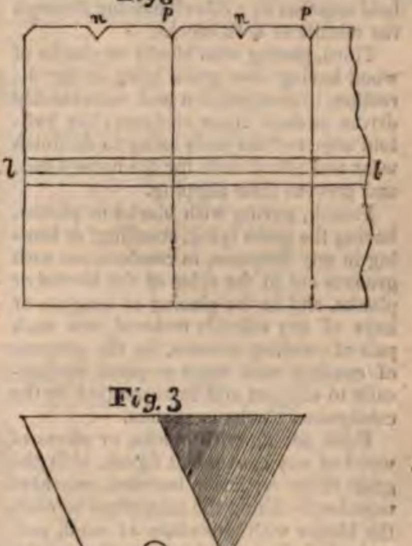


Fig 4

Fig. 3

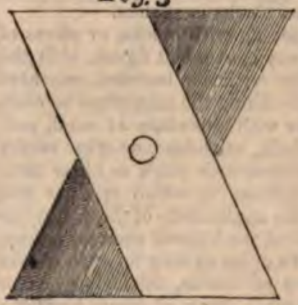
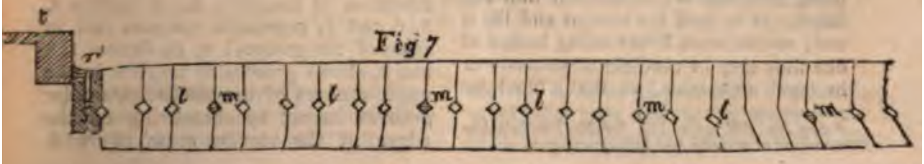


Fig 7



PARKIN'S IMPROVEMENTS IN WOODEN PAVING.

[Patent dated April 9; Specification inrolled Oct. 9, 1839.]

We return* to the specification of Mr. Parkin's patent, and now lay before our readers his "improvements in roads and ways", which consist, firstly, in paving them with blocks of wood having the grain inclined to the horizon in some angle, varying from about 45 degrees to about 70 degrees; the grain of all the blocks leaning in the same direction or towards the same point of the compass.

Second, paving with similar blocks, as in the first mode, but the alternate rows of blocks leaning towards the opposite points of the compass, each pair of opposite leaning blocks being sometimes held together by a dowell passing through the middle of both blocks.

Third, paving with blocks or planks of wood having the grain lying in any direction, in combination with nails thickly driven in their upper surfaces; the two-fold object of the nails being to diminish wear and afford hold for the horse's feet, and prevent their slipping.

Fourth, paving with blocks or planks, having the grain lying, standing, or leaning in any direction, in combination with grooves cut in the sides of the blocks or planks, and in the placing of tongues or keys of any suitable material into each pair of meeting grooves, for the purpose of causing each block or plank reciprocally to support and be supported by the contiguous blocks or planks.

Fifth, paving with blocks, or pieces of wood of any convenient figure, with the grain either vertical or inclined, cemented together by filling the interstices between the blocks with a mixture of sand, pulverised chalk, brickdust, or other earthy matter, united with pitch or other bituminous substance, which mixture will melt by the application of heat, but remain firm at the highest summer temperature. In order to take up such blocks or batches of blocks, for laying gas or water-pipes, a lever of iron, having a wooden handle, is provided; the iron end being made hot is thrust down into the interstices to melt the cement and lift it out; several such levers being heated at one time may be used simultaneously or in rapid succession, so that a block or batch of blocks, may be quickly separated from those surrounding. A plough or coulter of iron or copper is also provided for the same purpose, kept hot by a fire made around it, while it is drawn along the interstices.

Sixth, paving with blocks of wood of any figure, with a layer of sand, ashes, or sawdust, saturated with tar or other bituminous substance, laid upon the natural ground for the blocks to rest on.

Seventh, Cutting furrows or grooves in any direction a few inches apart, across the upper surfaces of the blocks of wood used in paving, whether the grain be vertical or inclined to the horizon; but in case of small blocks being used, the grooves, or furrows, are formed by the chamfering off the outer edge of the upper surfaces of the blocks; which furrows, and chamferings may be made deep and filled up with asphalte or other cement, or gravel and sand, in both cases the object being to prevent the horse's feet slipping.

Eighth, Laying down at the sides of streets, concave plates of cast-iron, nailed or screwed down upon longitudinal bearers of wood sunk at a proper depth below the road way.

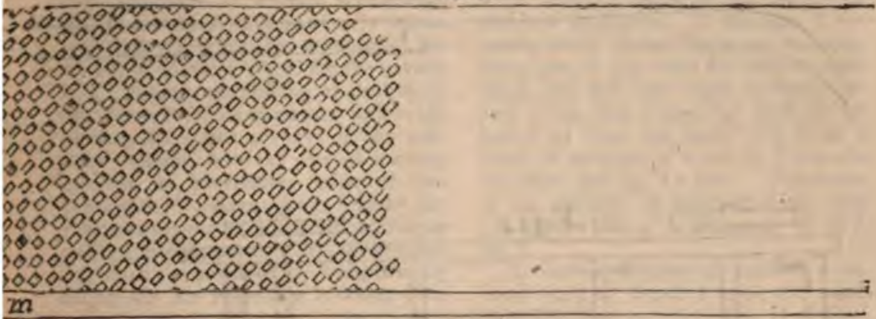
The manner in which these various improvements are carried into effect is shown by the annexed figures, and by the following explanation of the same:—

Figure 1 represents a view of a row of blocks of wood, with the grain inclining to the horizon; fig. 2, two blocks inclined in a similar manner; fig. 3, elevation of a pair of blocks leaning in opposite directions, and dowelled together; fiig. 4, plan of the same; fig. 5, plan of a plank thickly studded with nails; fig. 6, transverse section of two such planks tongued together; fig. 7, view of part of a row of blocks stretching across a street and appearing rectangular, the leaning being towards the length of the street; fig. 8, a pair of upright blocks in combination, with grooves for the reception of tongues between them and the contiguous blocks. *l*, in figures 1, 2, 6, 7 and 8, represents grooves for the reception of tongues; *m*, in figures 2, 5, 6 and 7, represents tongues laid in some of the grooves; *n*, in figures 1, 8 and 9, shows grooves or notches in the upper surfaces of the blocks; *p*, similar grooves formed by chamfering off the edges of the blocks; *q*, in figure 1,

* See No. 852, page 162, for Mr. Parkin's improvements in railway and other carriages.

grooves filled with asphalte; *r*, fig. 7, concave gutter plates nailed down upon wooden bearers; *s*, the wooden bearers; *t*, curb stones; *u*, flag stones. Figure 9, shows a batch of square blocks cemented together, which may be separated singly or in masses, and taken up by melting the surrounding cement. Fig. 10 shows a batch of blocks of various sizes and figures cemented together within a square

Fig. 5.



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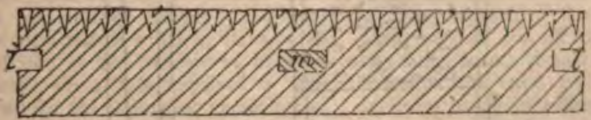


Fig. 9.

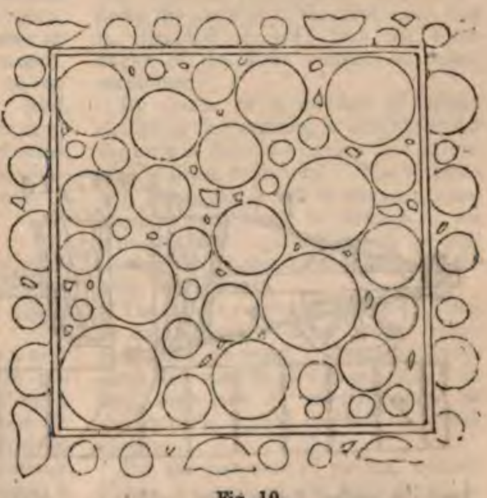


Fig. 10.

space, which batch may be removed in a mass when the cement is melted away from the *surrounding straight grooves*. Fig. 11, a lever of iron with handle of wood, the iron end to be heated for melting and lifting the cement out of the

spaces between the blocks. Fig. 12, plan of a truck carrying a fire place to give a continuous heat to a coulter for ploughing out the cement. Fig. 13, longitudinal section of the same; *n* the coulter, made of copper, which transmits the heat more freely than iron, and is not so soon burnt out; *p*, two braces to

Fig. 11.

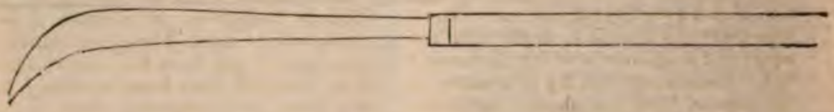


Fig. 12

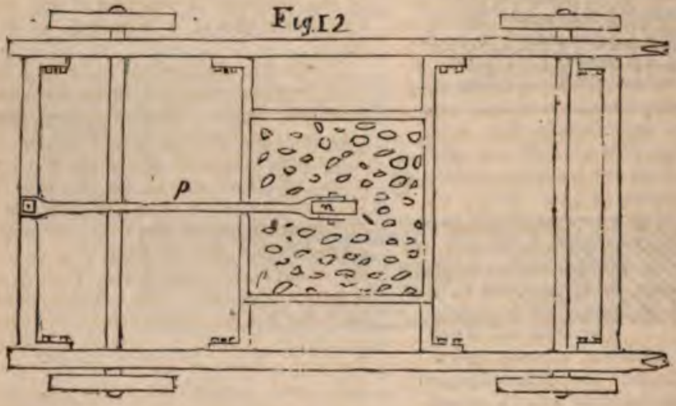
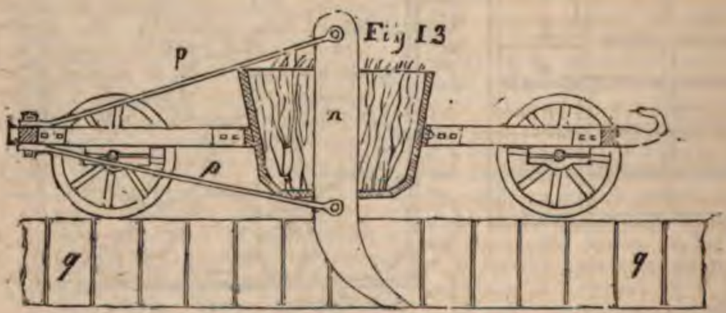


Fig. 13



keep the coulter firmly in its position in the midst of the fire; *q*, a row of blocks *from part of which* the cement is sup-*posed to be melted* away by the passage of the hot coulter; the parts of the truck are too obvious to need referring to.

Mr. Parkin lays claim to the first and second modes of paving, that is, with

blocks of wood having the grain inclined to the horizon from about 45 degrees to about 70 degrees; and the dowelling of the blocks together in pairs when standing. He thirdly claims the right of paving with pieces of wood having the grain vertical, horizontal, or inclined, in combination with a great number of nails driven into their upper surfaces to diminish the wear, and to afford a hold for the horse's feet. Fourth, the making of grooves in the sides of blocks or planks, and in the placing of tongues, or keys of any suitable material into the pair of meeting grooves for preventing either of two contiguous blocks or planks held by one common tongue or key from sinking or rising above the other. Fifth, the cementing blocks, or pieces of wood together, by filling up the interstices between them with a mixture of earthy matter, united with pitch, or other bituminous substance which will melt with heat, and yet remain firm at the highest summer temperature; and of using a hot iron lever, and a hot iron or copper plough, or coulter attached to a truck, to melt the cement out of the interstices between the blocks when it is required to take them up for the laying or repairing of water and gas pipes. Sixth, laying upon the natural ground or foundation of the road, a layer of sand, ashes, or sawdust saturated with tar, or other bituminous substance for the blocks to rest upon. Seventh, making grooves, or furrows in upper surfaces of wooden pavement, whether the grain be placed in an inclined, or in a vertical position. And eighth, the laying down concave iron plates upon longitudinal bearers of wood for forming the gutters of streets in combination with any kind of pavement.

HODGSON'S PATENT IMPROVEMENTS IN PAVING AND BUILDING.

[Patent dated June 27th. Specification inrolled December 27th, 1839.

This invention is founded upon a new principle of construction which the patentee states has been discovered by a "foreigner residing abroad," (Count de Lisle we believe) and communicated to him, and which he styles the "stereotomy of the cube." It consists in dividing a cube into pieces, thus:—He first divides the cube into two equal parts, by cutting it down the line *a b*, *fig. 2*; then of one of these halves of a cube he cuts off the upper corner from *c* to *d*, and the upper corner from *c* to *e*; of the other half he cuts off the lower corners from *f* to *g*, and from *f* to *h*. There will thus remain of the cube two isosecles triangles —the exact measure of the angles of which is 63 degrees, 26 minutes, 5 seconds, and 8 tenths. These two triangles being placed with their flat sides to each other, and with their bases reversely to each other, and supposing them to be joined by their flat faces, will form a block of the form of which fig. 1 is a side elevation, and fig. 2 a plan. The shape of the surfaces of junction of the two triangles is that of a diamond—as at *i*, fig. 1.

He further dissects the cube in a second manner, founded upon the same principle, thus:—The cube is divided into two equal parts as at first (*a b*, fig. 4). The upper corner of one of these halves is cut off from *c* to *d*, fig. 3, and the lower corner of the same half from *e* to *f*; of the other half of the cube, the upper corner is also cut off from *c* to *g*, and the under corner from *h* to *f*. Thus there is left of the cube two parallelopipeds inclining in *opposite directions*, and when put with their flat surfaces together, forming a block of the shape shown by figs. 3 and 4, which are a plan and section thereof; the surfaces of junction being the same as in the first case, that is, diamond shaped; and the acute angles of the same measure as before mentioned.

By means of a number of blocks shaped in this manner, a substitute for the arch is formed—having the advantage of being horizontal. The patentee also states that it will be stronger, inasmuch as every block or division of the structure is brought into action in supporting the whole, and not the key stone only, as in an arch.

The blocks or pieces may be formed of any material;—either stone, brick-earth, iron, or wood. When of brick-earth they may be cast in moulds; if in iron, they may be merely frames, as shown in fig. 5, and rivetted or bolted together.

For the purposes of paving, wooden blocks are made of the form shown in figures 3 and 4; the parallelopipeds being joined together by a pin at *i*, fig. 3.

Fig. 1.

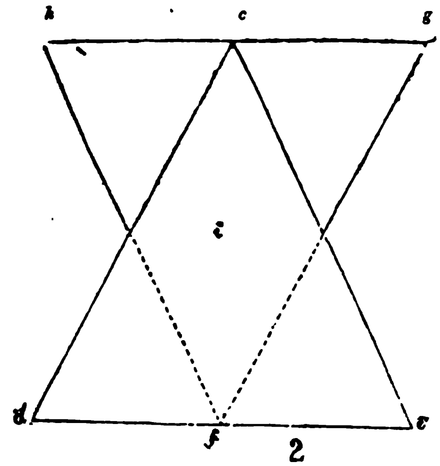
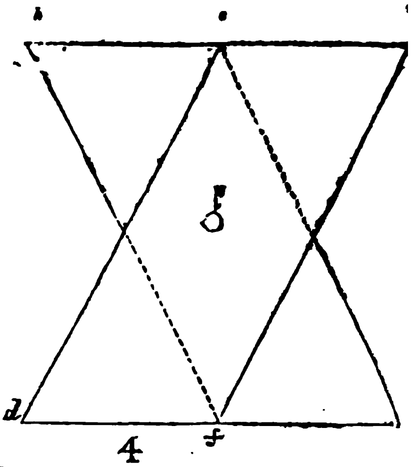


Fig. 3.



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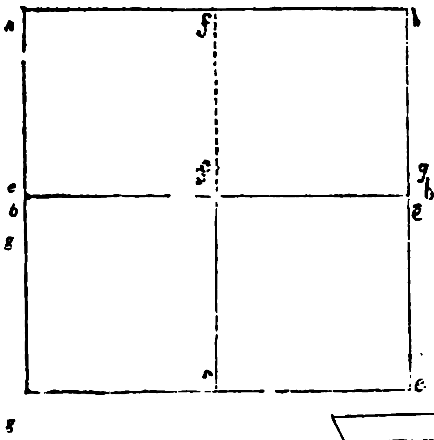

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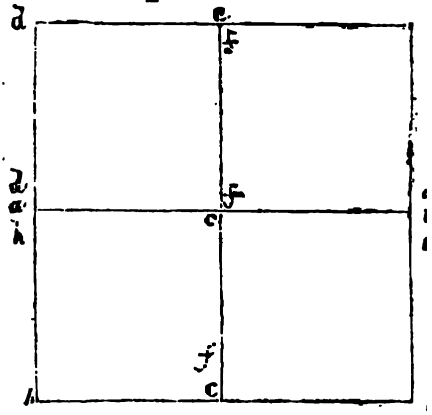

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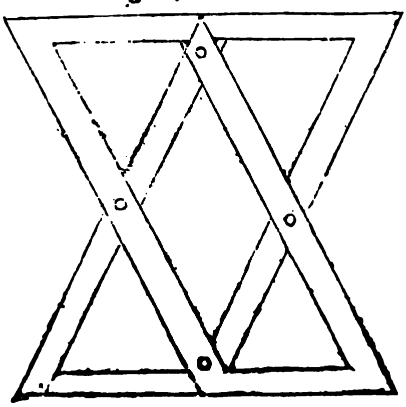


Fig. 5

A sheet of drawings accompanying the specification exemplifies various ways of applying this principle of construction to building and paving, railway-making, and in building a column; but the figures we have given are sufficient fully to explain the whole matter.

A piece of pavement constructed upon this plan was laid down in Parliament-street, opposite Whitehall, and opened for traffic over it on the 23rd of last month, December; on the 25th it had become so completely broken up as to be impassable, and was consequently closed in. The fault was laid upon the substratum, which was stated by the patentee not to have been sufficiently hardened and prepared. He was accordingly allowed to relay his pavement, making such a substratum as he deemed necessary, and taking advantage of all the improvements suggested by the first experiment. The pavement was a second time opened on Monday last, the 13th instant. It appears to us that this plan of wooden paving will not be found to answer; the parallelopiped blocks are placed so as to act like so many levers, all tending to displace one another on a weight passing over them. Referring to fig. 3 it will be observed that as soon as a weight comes upon the point *e*, and depresses it, the contrary point *d* will be elevated, the lever turning on the pivot *i*, and raising the next block, and so on in succession: thus the whole structure will be liable to constant disturbance throughout, upon the passing of a carriage over its surface.

We cannot observe any material difference between the paving block figs. 3 and 4 of Mr. Hodgson's specification, and that represented figs. 3 and 4 of Mr. Parkin's. The latter patentee, who has the priority in point of date, claims all angles from 45 to 70; the former confines his claim to one precise angle.

JOHNSTON'S HINGE-MAKING MACHINERY.

[Patent dated July 20; Spec. inrolled, Oct. 1839.]

This invention consists in the construction of apparatus for forming the sockets or eyes through which the pin or rivet connecting the two parts of the hinge, *passes*.

Pieces of ductile or malleable metal are stamped out, of the shapes required to form the hinge; that is, into flat pieces having tongues or projections which, when bent down, form the eye or socket. These tongues are first partially bent by being nipped by a die on the underside of the end of a lever. The piece of metal with the tongues thus bent is removed from the die, and subjected to a second process to form the eyes. A steel die is made, having a plane surface rising at a slight angle from the front, and at the back curving upwards and returning in about the shape of a semicircle. The tongues are bent by forcing them, end foremost into and against the concavity of the die, by which they, conforming to its curve, become bent, and turn over till they touch the point at which the tongue projects from the plate; the length of the tongue having being calculated so as to produce this effect.

The apparatus to perform these two actions is combined in one machine, of which we shall probably on some future occasion give an engraving and further description.

LIFE AND LABOURS OF TELFORD. NO. IV.

The Caledonian Canal—Sketch of the Line—Sea Locks and other Works—Failure of the Canal in a commercial sense.

Telford had been for ten years employed upon the Ellesmere Canal, and others of inferior importance, when he became connected with a work of unusual magnitude—indeed the greatest of its kind upon record—the Caledonian Canal.

It is scarcely possible to cast an eye upon the map of Scotland, without noticing the very remarkable succession of lakes which make nearly an island of the northern part of the country, and seem intended by nature to afford, with no great assistance from art, a navigable passage through the very heart of the Highlands. The idea of constructing a navigable canal in this direction occurs almost as irresistibly as that of effecting a similar communication through the isthmus of Panama; both of them tasks, doubtless, much more difficult of execution in reality than would be dreamed of by the most ingenious projectors upon paper.

The singular valley called the Great Glen of Scotland, commences between the promontory of Burgh Head, in Elginshire, and Cromarty, and passes through a succession of sea inlets and fresh water lakes, to the southern extremity of Cantire, a distance of 200 miles, nearly in a straight direction between the Naze of Norway and the north of Ireland. The whole of this length being occupied by lakes and rivers, with the exception of a space of twenty-two miles only, it apparently required but a canal of that length to unite the eastern and western coasts of Scotland, and save 500 miles of difficult and dangerous navigation, by way of the Orkneys and Cape Wrath. It may be readily imagined, therefore, that the project of cutting through the short space of intervening land must have been often entertained.

It is said that a plan for this purpose was in agitation at least so far back as the year 1713, but it was not till 1773 that any real progress was made. In that year the commissioners of the estates forfeited in the rebellion employed the celebrated James Watt to examine and report upon the practicability of the plan. He decided in its favour, and recommended a canal of ten feet depth of water; but the forfeited estates being restored in 1784, the project fell to the ground. It lay dormant till the first year of the nineteenth century, when the British government, urged chiefly by political considerations arising out of our then position with regard to the chief maritime powers of the north, arrayed against us by the power of Buonaparte, employed Telford to survey both the coasts and the interior of Scotland, and report generally as to their state, and the most advisable improvements to be undertaken. The principal objects in view were to remedy the want of a great naval station in the north of the kingdom, and to provide employment for the Highlanders of Scotland—an object at that time much pressed upon the attention of government, and which they had taken into very serious consideration.

The result of Telford's investigations was, that he recommended the establishment of naval stations and the improvement or erection of forts in various situations; the construction of roads and bridges throughout the Highlands; and, finally, the opening of a navigable communication through the Great Glen of Scotland, by the Caledonian Canal. All these improvements were determined upon, and, two boards of commissioners having been appointed to carry them into effect, operations were soon vigorously commenced, and the grand navigable connexion between the eastern and western shores of North Britain was at length actually in process of formation.

About one mile from the mouth of the river Ness, the tideway of the Beauley Water is from five to seven fathoms deep; and here, at the fishing village of Clachnacharry, is the entrance to the Caledonian Canal. The very first step to be taken was a step of extraordinary difficulty, since, in order to secure an entrance for vessels having twenty feet draught of water at the height of neap-tides, it was necessary, from the flatness of the shore, to place the tide-lock 400 yards from high water mark, at the end of an embankment—of which more anon. From this lock the canal is carried between artificial banks on a flat mud shore, till it reaches high water mark at Clachnacharry, where another lock is placed in a stratum of firm clay. Immediately to the south of this is formed a floating dock, 967 yards in length, and 162 in breadth. It is furnished with a wharf wall and warehouse at the south end, and occupies an area of thirty-two acres. At the south end of this basin, the Great North Road passes over a swing bridge, and adjacent to it are the four united Muirtown locks, each 80 feet long and 40 feet wide, and with a total rise of 32 feet, raising the canal to the level of Loch Ness, in its ordinary summer state. From these locks the canal, whose dimensions are 50 feet at bottom, and 120 feet at the surface, with a depth of 20 feet, proceeds in the rear of the picturesque insulated hill of Lomnahurie, to the river Ness at Torvaine, where, in consequence of a precipitous bank, it is constrained to occupy the former bed of the river, in order to effect which the Ness was *sans ceremonie* turned out of the course it had taken from time immemorial, and compelled to proceed in a new channel, excavated for it on purpose, so that at this spot nature and art have fairly changed places. The same kind of difficulty, though less in extent, is twice overcome, in the same manner, before the canal reaches the

small Loch of Doughfour (six miles from Clachnacharry), by a regulating lock 170 feet long and 40 wide, which is actually placed in the old channel of the river Ness, heretofore divided at this spot by an island of gravel.

Between Loch Doughfour and the outlet of Loch Ness at Bona Ferry, the river itself is made use of as part of the line, having been deepened for that purpose. Loch Ness is 22 miles in length, and nowhere less than a mile in breadth, while in depth it varies from five to no less than *one hundred and twenty-nine* fathoms—the latter a greater depth than can be found in the German Ocean itself, between the shores of Scotland and those of Norway! At the south-west end of the Loch stands Fort Augustus, where the canal may be said to recommence, just where the river Aich enters the lake. Here it ascends 40 feet by means of five connected locks, each 180 feet in length, and proceeds in the course of the river till it joins Loch Aich, after passing the Kytra lifting lock, and a regulating lock, each 170 feet by 40, and occasionally occupying the bed of the river.

Loch Aich forms the summit level of the Caledonian Canal, and is the last of this remarkable range of lakes which drains towards the east, or the point by which we have approached it. It is of irregular depth and breadth, but affords an abundant supply of water, receiving as it does the river Garry, which drains Loch Garry and Loch Quoich, two large pieces of water out of the line of the canal. From the western end of Loch Aich to the eastern end of Loch Lochy, is a distance of only two miles, the only piece of dry land which intervenes to prevent the natural division of Scotland into two islands. The ground of this isthmus is extremely rugged, and the canal is carried through a cutting of 40 feet in depth. Near Loch Lochy are a lifting lock and a regulating lock, the difference in the height between that and Loch Aich, although so near, having been 22 feet, though now reduced, by raising the surface of the former, to 10 feet only.

At the south-west end of Loch Lochy there is another regulating lock, and the canal is carried along the side of the river Lochy, over difficult ground, intersected by a considerable river and numerous mountain streams. The ordinary level of Loch Lochy is adhered to until within one mile of Loch Eil, where one of the most stupendous features of the whole work occurs, in the shape of a group of eight connected locks, each 180 feet long and 40 wide, and falling altogether 64 feet. From this point the canal continues on a level to Corpach, where are two connected locks, and a single sea-lock, entering the tideway of Loch Eil, from whence there is an uninterrupted communication with the sea to the westward. This lock, therefore, completes the line of "the Caledonian Canal."

Having thus traced the course of this magnificent undertaking, it remains to describe its most striking and characteristic details. The canal differs from others chiefly in its dimensions, which, for deep cutting, embanking, and sluicing, required a vast expense. Another point of importance also was its situation; and, although the fresh water lakes were advantageous as forming nearly forty miles of its length, the advantage was far greater in appearance than in reality, as, by causing a necessity for no less than eight junctions at different stations, much cost, labour, and difficulty were occasioned, and the exercise of great skill and contrivance called for on the part of the engineer. The numerous and gigantic locks on the line of the canal are indeed the most remarkable portions of the whole work, and those in which the genius of Telford shines with the greatest brilliancy. Among these, perhaps the most worthy of minute observation is the Lea Lock at Clachnacharry, which forms the eastern entrance to the canal.

The shore of Loch Beauley at this place has already been described as extremely flat, so that it was necessary to carry the canal by artificial embankments 400 yards beyond high water mark, at a situation where the shore was composed of soft mud, into which an iron rod could easily be thrust to a depth of 55 feet. It seemed impracticable to enclose by a wooden coffer-dam a space for a lock 170 feet long and 40 feet wide, with the requisite recesses and wing-walls, the elasticity of the mud preventing the usual process of pile-driving, by causing a rebound after every stroke of the engine. Telford therefore determined on

the adoption of a new, and, as it proved, perfectly effective method. Abundance of heavy mountain clay being found in the base of the hill immediately above high water mark, an iron railway was laid down, and the two banks of the canal were thus carried out from the shore into 20 feet depth of water; and on approaching the site of the intended sea lock, the two banks were united into one mass, and pushed considerably beyond the extent which the intended lock would occupy, so that the weight of the incumbent mass of clay compressed the mud and squeezed out the water. Upon this large mound a quantity of stone (aftewards used in the building) was laid, and the whole suffered to remain for about six months, during which time the mass sank about eleven feet. When it became evident that no further sinking would take place, the stones were removed, and a lock-pit excavated in the now solid mound, the water being kept under at first by a chain-pump worked by six horses, and afterwards by a steam engine of nine horse power.

As soon as the lock-pit was dug, rubblestone masonry was laid in hydraulic mortar, to the thickness of two feet in the middle, and five feet on each side; upon this the inverted arch of square masonry was laid, and the side walls founded; after which the chamber walls, counterfeits, recesses, and wing walls were carried up without difficulty. The masonry in the bottom part was judiciously worked in lengths of about six yards, to prevent the compressed mud from again softening and rising up in the newly compressed space. This substance was readily penetrated by the piles, but it is most remarkable that whenever the strokes of the pile-driver ceased for a few hours, no power could drive them further in, or draw them out again.

This novel plan for overcoming an apparently insuperable obstacle, which was invented and adopted by Telford from the actual necessity of the case, turned out in the end, as it deserved to do, triumphantly successful. Not only has it completely answered its purpose, but it was found, when the calculation was made, to have been actually less expensive than a coffer-dam would have been, even could that usual expedient have been adopted, which was flatly impossible. The "Sea Lock at Clachnacharry" will long remain a memento of the practical skill of its constructor, and the mastery of his mind over the toil and trouble of adverse circumstance.

Difficulties of a different kind had to be overcome at Capach, the other extremity of the line. It was necessary to connect the canal with the tideway of Loch Eil, on the north side of a rock situated beyond high water mark, and covered at three-quarters flood, and the lock was to be advanced far enough into the lake for the entrance-sill to be laid upon the rock, so that there might be 20 feet depth upon it at high water of the neap-tides. For this purpose a water-tight mound, faced with rubblestone masonry, was carried from the shore to beyond the extremity of the lock-pit, and between the mound a wooden coffer-dam was constructed. This expedient also proved successful, although the driving the main piles and fixing the wooden frames securely were operations of singular difficulty. In the middle part of the line also, near Fort Augustus, there was another strong call on the ingenuity of the engineer, the ground on which the five connected locks are placed being composed of a loose gravel, while the lower lock required its entrance-sill to be 20 feet below the lowest surface of Loch Ness, and its very site was occupied by the channel of the river Aich. The great flow of water into the works was of course the chief difficulty to be mastered, and to do this required a vast expenditure of time and labour. The works were in operation no less than four years, but in the end the object in view was fully accomplished by the force of Telford's ever-ready resources, supported by the all-conquering power of steam, whose assistance was during the whole time in constant requisition.

In the course of the execution of the canal, Telford introduced several novelties of construction. He had already distinguished himself at the Ellesmere Canal by making a partial use of cast-iron in the lock-gates of that line, and even in one instance had achieved a victory over a quicksand which had swallowed up whatever masonry was erected upon it, by contriving the whole of a lock, with its bed, of the same useful material! At the Caledonian Canal he proceeded in the same course, almost

from necessity, proper timber of the dimensions necessary for the lock-gates being hardly procurable, even at exorbitant prices. These were, therefore, all of cast-iron, and the bridges also were of that metal, in the introduction of which to the important station it now fills in most works of importance, Telford had probably a far greater share than any of his contemporaries.

Notwithstanding all the credit attached to Telford's engineering labours, on this occasion, however, it must be admitted that the Caledonian Canal, as a whole, fell far short of the expectations formed of it. It is indeed a magnificent work, but its results disappointed public expectation, and its constructor reaped more of mortification than aught else, from his connexion with it, from first to last. For one thing, the original estimate was under half a million, while the actual expenditure amounted to very nearly double the sum. This amount being doled out by Parliament in annual instalments spread over twenty years, an opportunity was every now and then afforded for opposition orators to "embarrass ministers," by insinuating a charge of profusion against the engineer and his employers, especially after the original estimate began to be exceeded; and the public, thus never hearing of the Caledonian Canal but as an odious job, at length became weary and disgusted at its very name. It may be admitted that Telford was mistaken in some points of his estimate for a work so complicated and extensive, but the excessive and unforeseen rise in the price of timber, during the progress of the work, was of itself sufficient to account for the greater part of the discrepancy to reasonable observers, among whom parliamentary tacticians are not always to be included. Be that as it may, it is certain that Telford yielded at length to the clamour, and consented, or felt compelled to consent, to "huddle up his work" in a most incomplete and unsatisfactory manner towards the period of (what should have been) its conclusion. The natural effect of this was, that the efficiency of the canal became greatly impaired, and that, instead of a uniform depth of 20 feet being preserved, the operations were finished on so reduced a scale, that 11 or 12 *feet only are now in some places to be relied upon after* a season of drought. Besides all this, the later works of the canal were so economically slurred over, that they are already greatly out of repair, and require extensive renovations. Mr. James Walker, the successor of Telford in the chair of the Institution of Civil Engineers, was employed by Government to survey the work in the beginning of 1838, and he reported that the repairs, with such alterations as he would recommend, and the necessary "finishings" of the incomplete works, would require an outlay of little less than 150,000*l*. The same gentleman urged on his principals to encounter this expenditure by drawing a startling picture of the probable effects of delay in the inundation of the surrounding country, and other dreadful consequences; but Mr. Walker, it may be remarked, is an engineer of anything but a sanguine temperament, and therefore it may be doubted whether the case would be quite so bad as he anticipates, even if the canal from which so much was expected were (as some have proposed) to be left to itself, and given up altogether as a navigable communication—a measure which, he asserts, could not, extreme as it is, be carried into effect with safety to the neighbourhood of the line.

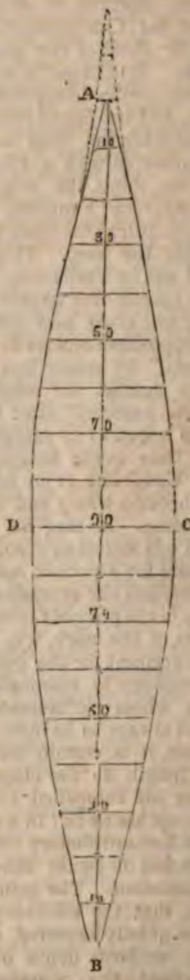
While this canal cost so much more than had been estimated, the returns of the traffic fell far, very far short of what every one had expected. The line, although unfinished, was opened in 1822, and from that time to 1829, the total receipts amounted only to the trifling sum of 20,000*l*., so that nothing could be more manifest than its failure in a commercial point of view; and this, added to the odium cast by other circumstances on the concern, still further goaded Telford to conclude his labours as quickly and as cheaply as possible. Here our fiscal regulations were against him. The chief tonnage on the canal was expected to arise from the transit of Baltic timber, but political circumstances have so concurred, that a duty almost amounting to prohibition has, whether from a mistaken policy or no, been laid upon timber from that quarter ever since (as it had been before) the completion of the undertaking, so that it is absolutely cut off from its main chance of usefulness, and not allowed to fulfil the chief end contemplated in its formation. In addition to this, it is probable that the intro-

duction of steam navigation, by which the importance of adverse winds and waves is reduced almost to nothing, has had a great share in keeping the traffic in the free and open sea, rather than the heltered but expensive line of the canal. Whatever the causes, certain it is that the Caledonian Canal has ever been, and is in an almost deserted state, and has consequently reflected much more honour on Telford as the engineer who constructed it, than as the economist who recommended its adoption.

MODE OF FORMING GORES FOR GLOBES.

Sir,—The review of my Treatise, at page 22, has made me acquainted with your Magazine, which I had not previously been in the habit of reading. As you receive contributions, if you think the following method of projecting maps and globes, by means of the sector, suited to your pages, you will oblige me by its insertion. It will not be necessary to detail all the various modes of laying down meridians and parallels, which are usually done by means of tables: the same method that applies to one, will, of course, apply to the whole.

Gores for Globes.—Since the gore is to reach half round the globe, its length will obviously be half as many times its equatorial breadth as there are gores intended. Thus, if there are to be 12 gores, the length of each will be 6 times its breadth, and so on. Suppose then this number be required. Draw a line AB equal to half the circumference of the globe; and, by means of the line L of the sector, divide it into 18 equal parts, and number them as in the diagram. Take half of this line, and find its sixth part, which set off from 90 to C, for half the middle or equatorial breadth of the gore. Do the same with the other side to D. Make this sixth part a parallel distance from 90 to 90 on the line of sines: take off the parallel distance from 80 to 80 of the same, and apply it to 80, 80 of the diagram, north and south. Do the same with the rest, and trace out a curve line connecting the extremities. The numbers are marked *the contrary way to the latitudes, to prevent confusion in taking the complements; for the parallels on the globe are* to each other as the cosines of their latitudes; these cosines, in fact, becoming the successive radii of the concentric circles. A spherical balloon is, of course, projected in the same manner. If it be desired to give it a neck, the parallel distance of 70 should be laid down at A, and the vertex carried two spaces farther, as shown by the dotted lines. The lower section gives the gores for parachutes and umbrellas; the upper, those



for parasols. In maps the parallels are to be drawn first, and the meridians set off as above, except in Mercator's charts,

in which the meridians are to be drawn as parallels, and the parallels set off from the secants; for the secants are reciprocally as the cosines.

SLIDE RULES.

Mr. Pole, at page 165, gives two formulæ for calculating the sides of triangles. I was not aware that the sines and tangents had hitherto been laid down, and have, therefore, been causing some compound slide-rules to be constructed, intended more immediately for the use of schools, for the purpose of disseminating, in the most efficient way, the knowledge of "an instrument, the value of which, I am sure, is far from being so well known and appreciated as it deserves to be." They may be obtained of Messrs. Relfe and Fletcher, Cornhill, for a trifling expense: style and finish, in getting them up, have been made subordinate to the design of rendering them accessible to parents, who might otherwise overlook their utility from consideration of the cost.

In the case in which the hypothenuse and one of the sides are given, the other side and the angles are obtained at once; for, placing c under 90, then over b is its angle, and under its cosine the other side a; or, represented as a formula,

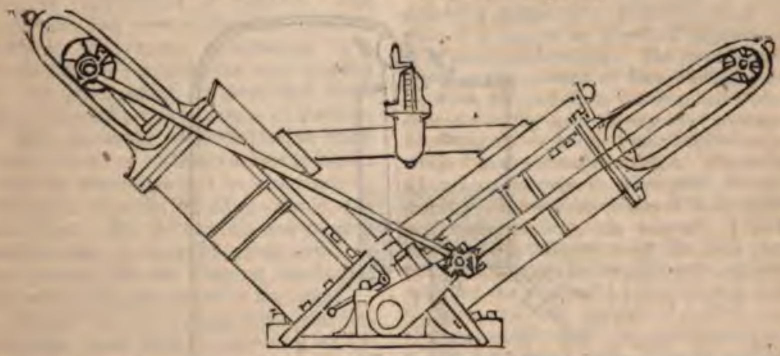
$$\frac{\cos. B}{a} \quad \frac{\sin. B}{b} \quad \frac{90}{c}$$

When, however, the two legs are given, there seems no direct way of obtaining the hypothenuse at once, except by some skilful contrivance similar to Mr. Woollgar's, whose pocket calculators I endeavoured to obtain from Mr. Rooker, but found he did not keep them by him, which, I think, is to be regretted, as well as that the instrument makers generally do not sell them.

T. Kentish.

Luton, Jan. 7, 1840.

CRICKMER'S OBLIQUE CYLINDER ENGINE.



Sir,—Seeing in your valuable journal, a description of the engines of the *Alice*, I beg to inform you that it is an arrangement that I have long thought suitable to the locomotive and marine engine; the fact being known to many of my acquaintance, and also to Mr. Drubble, axle-tree maker, to whom I mentioned it. He will recollect that I did so three or four years ago, at which time I was manufacturing a steam-engine for him. How close my plan may resemble the engines of the *Alice*, I cannot say, but leave it to those that have seen them to judge: my view was to do away with the weight of the framing. The above sketch I deem sufficient; the connecting rods of each engine were intended to be connected to the same crank; the slides to be worked by an eccentric on the shaft between the cylinder bottoms.

Your obedient servant,

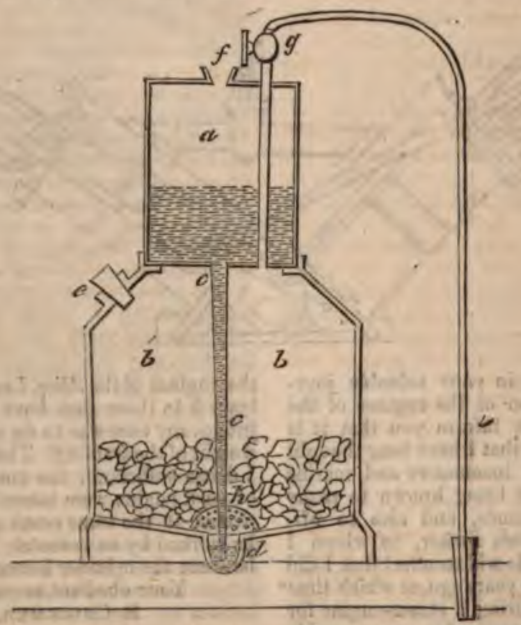
R. Crickmer, Engineer.

Temple-street, Jan. 7, 1840.

CARBONIC ACID GAS APPLIED TO THE PRESERVATION OF BEER IN DRAUGHT, WITH A DESCRIPTION OF THE APPARATUS.

Sir,—It is well known that any liquid which has undergone the *vinous* fermentation, or any alcoholic solution containing a due proportion of yeast, upon exposure to warmth, and atmospheric air, very rapidly passes into the *acetous* fermentation; and this transition takes place so rapidly, that in some instances, where it is important to prevent it, this is with difficulty effected. I need not say how important it would be could this tendency to fermentation be overcome, especially with respect to malt liquors. During the hotter months of the year, when we most need a good and wholesome beverage, we must either drench our stomachs with an unwholesome and unpalatable fluid, frequently the exciting cause of dangerous diseases, as diarrhœa, cholera, &c., or we must resort to the purer, but rather unpopular drink supplied by nature. To many individuals the latter alternative would be of no consequence, but to the hard-working labourer, to whom porter is a necessary luxury, it would be a source of no small punishment. Many schemes have at various times been proposed, but as no *one* has been generally adopted, I presume they have not fulfilled the desired intention.

It is apparent that two methods exist by which the acetous fermentation may be arrested or entirely prevented; one to prevent the fluid attaining a high temperature, the other to exclude the admission of oxygen into the cask in an uncombined mechanical state, as in the case of atmospheric air; the former, of course, is impossible during summer, but the latter may be readily effected by supplying a gas which contains no oxygen except it be chemically combined. Carbonic acid gas will, I believe, completely effect this desirable object; it can be generated in large quantities at a trifling expense, and with a proper apparatus readily applied. Convinced that the subject is an important one, I have taken the liberty of sending you the following diagram with description, &c.



The apparatus consists of two chambers *a, b,* communicating through the pipe *c*, which is nearly prolonged to the bottom of the well d; e, an opening into

the lower chamber; *f*, an opening into the upper chamber; *g*, a stop-cock and elastic tube, terminating in a brass nose fitted air-tight into the cask upon which it is supposed to stand; *h*, a covering or sink to the well, perforated with numeous holes, through which the pipe *c* passes.

Its application is as follows:—In the upper chamber a dilute acid is introduced through the opening *f*, which (*to prevent explosion*) must never be closed; into the lower chamber, marble, or some other carbonated alkali, is introduced in small pieces through the opening, *e*; now, it is obvious, that immediately the acid passes down the pipe *c*, violent chemical action, accompanied with disengagement of carbonated acid gas, takes place, the gas finding no exit presses upon the surface of the acid, forcing it into the upper chamber again, and will remain there until the gas is drawn off through the pipe *i* into the cask, and as long as fluid is running from the cask, gas will be generated to supply its place, and the acid instantly driven into the upper chamber the moment a supply is no longer required. The stop-cock, *f*, is not required, except for the convenience of removal. The floor of the lower chamber inclines towards the centre, terminating in a small well to facilitate the acid passing to the pipe, which is protected from pieces of solid alkali by means of the sink.

The apparatus may be constructed either of lead or earthenware; the latter, from its cheapness and its resistance to the action of acids, would, probably, answer best. For the convenience of manufacturing, it may be constructed in two pieces, like the filtering machines; of course the joint must be air-tight.

Should the above suggestion and description meet your approbation, its insertion in your valuable journal will confer a favour upon

Your obedient servant,

ED. U. BERRY, Surgeon, &c.

7, James-street, Covent-garden, Jan. 4, 1840.

STEAM AT SYDNEY.

Sir,—I observe in your number for Dec. 21st, under the head of "Steam at the Antipodes;" some notice of a company having been formed at Sydney, with the view of giving a greater extension to their existing steam marine operations. I entertain no doubt that the *great benefits to be derived from the employment of steam vessels*, have been already felt in that distant and fine colony, and that it will prove, particularly there, as in all young countries, and others with imperfect internal communications, of the utmost importance.

It may not be uninteresting to your readers to know, that the first steamer, called the *Sophia Jane*, that navigated the Australian seas, was equipped and sent from the port of London, as a joint private speculation between my late partner Mr. Barnes and myself; and that, although the vessel is even now one of their most efficient, if not the most efficient, and has always performed extremely well, yet, from circumstances over which the parties here had no controul, it proved, as it sometimes does in such undertakings, the cause of serious pecuniary loss to the first speculators; nor do I think among the number of those at present in use in the colony, has any other vessel been sent from this port.

If any other particulars respecting the vessel should be considered interesting, I shall feel much pleasure in supplying them.

And remain, Sir, yours, &c.

JOSEPH MILLER.

Monastery Cottage, East India-road, Jan. 2, 1840.

"NORWICH-PORT" NO FAILURE.

Sir,—Although this work may be considered a failure in a pecuniary point of view, it is not so as a work of engineering or of great public utility. The city is benefitted to the amount of three shillings per ton upon all goods from London, and a considerable saving upon the export of corn and flour, besides in many other indirect ways which I have not data to quote. The same advantages are open to other ports, if parties chose to avail themselves of it, by sending vessels on their sole account. I have seen an advertisement to let the tolls (but not to sell the works) in our papers, and the tolls for the last seven years are here said to have produced upwards of 1,700*l.* per annum, and not as your correspondent states, a little more than 1,000*l.* What his motives can be for this "unkind cut" is a mystery to yours, truly, W. THOROLD.

Norwich, Jan. 14, 1840.

SOLUTIONS OF ASTRONOMICAL QUESTIONS.

Sir,—Nautilus appears to me to have mistaken the drift of Iver Mc Iver's astronomical question, for on this subject I have generally observed that by using a certain notation Iver always contrives to solve his questions in a far shorter way than that which could be done by following the common beaten track.

In the following investigation I have adopted a similar notation to that which Iver has done in his solution of an astronomical question (No. 830).

The following rule will give a far shorter solution to the question than the method proposed by Nautilus (No. 853).

I am, Sir,
Yours, &c.,
GEORGE SCOTT.

January 5, 1840.

Rule.—Let L and L′ denote the latitudes of the two places, of which L is the greater, 2 A their difference of longitude, D the sun's declination; 1st, find an arc θ such that cos $\theta = \frac{\tan. L'}{\tan. L}$. 2nd. Find an arc x so that $\tan. x = \cot. A \tan^2. \frac{\theta}{2}$. Then will $x \pm A$ be the sun's meridian distance for both places; and $\tan. D = \frac{\tan. L'}{\cos. (x+A)} = \frac{\tan. L}{\cos. (x-A)}$.

By the Nautical Almanac (1840) the latitudes of the observatories of Greenwich and Edinburgh are 51° 28′ 39″ N. and 55° 57′ 23″ N. Longitude of Edinburgh 3° 10′ 54″ W.

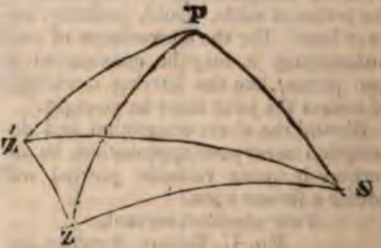
Trigonometrical Solution.

Lat. Greenwich	51°	28′	39″	tan.	10.099045	tan.	0.099045
„ Edinburgh	55	57	23	tan.	0.170300		
θ	31	55	53	cos.	9.928745		
$\tan.^2 \frac{\theta}{2}$	(15	57	56½)	....	8.913028		
A............	1	35	27	cos.	1.556387		
x	108	44	36	tan.	10.469415		
∴ The Mer. Dis. for Greenwich is..	107	9	9	..	..	cot.	9.469415
D...........	13	12	44 N.	..	..	tan.	9.370653

Consequently the apparent time at Greenwich is 4h. 51m. 23s. A. M., and the two days that correspond nearest to the sun's declination is April 25, and August 18.

Any one who may choose to solve the question by the method proposed by Nautilus, will find the calculation nearly double the above.

Demonstration of the above Rule.—Let Z and Z′ represent the zeniths of the two places, S the sun, and P the celestial pole, and draw the great circles as in the diagram. Let 2 A denote the difference of longitude, or the measure of the spherical angle Z P Z′, L and L′ the latitudes.



Assume the angle $Z' P S = x + A$ ∴ $Z P S = x - A$. By spherics $\cos. Z' P S = \frac{\cos. Z'S. - \cos. P Z'. \cos. P S}{\sin. P Z'. \sin. P S}$. But $\cos. Z' S = \cos. 90° = 0$ ∴ $\cos. Z' P S = - \frac{\cos. P Z'. \cos. P S}{\sin. P Z'. \sin. P S}$. Similarly $\cos. Z P S = - \frac{\cos. P Z. \cos. P S}{\sin. P Z. \sin. P S}$. Hence $\frac{\cos. Z' P S}{\cos. Z P S} = \frac{\cos. (x+A)}{\cos. (x-A)} = \frac{\cos. P Z'. \sin. P Z}{\sin. P Z'. \cos. P Z} = \frac{\sin. L'. \cos. L}{\cos. L'. \sin. L} = \frac{\tan. L'}{\tan. L}$. As-

sume $\frac{\tan. L'}{\tan. L} = \cos. \theta$.·. $\cos. \theta = \frac{\cos. (x+A)}{\cos. (x-A)} = \frac{\cos. x. \cos. A - \sin. x. \sin. A}{\cos. x. \cos. A + \sin. x. \sin. A}$ $= \frac{\cos. A - \tan. x. \sin. A}{\cos. A + \tan. x. \sin. A} = \frac{1 - \tan. x. \tan. A}{1 + \tan. x. \tan. A}$ hence tan. x. tan. A + tan. x. tan. A. $\cos. \theta = 1 - \cos. \theta$.·. $\tan. x = \frac{(1 - \cos. \theta)}{\tan. A\,(1 + \cos. \theta)} = \cot. A \left(\frac{1 - \cos. \theta}{1 + \cos. \theta}\right) = \cot.$ $A. \tan^2. \frac{\theta}{2}$. Lastly, in the quadrantal triangles, Z P S, Z' P S, $\cot. PS = \frac{\cot.\ PZ}{\cos. ZPS}$ $= \frac{\cot. PZ'}{\cos. Z'PS}$ or $\tan. D = \frac{\tan. L}{\cos. (x-A)} = \frac{\tan. L'}{\cos. (x+A)}$.

A great many important astronomical deductions might be shown to follow from the above question by varying the values of L', L', 2 A and D, and among them an answer to Nautilus's astronomical question, although it may be answered without any calculation whatever.

G. S.

NAUTILUS'S ASTRONOMICAL QUESTION.

Sir,—If Mr. John Nelson had attentively considered the terms of my definition at page 182, he would not have ventured to give, as an answer to my question, the trite and commonplace approximation to equality of day and night, popularly supposed to take place at the equinoxes. That definition was as follows:—"To enable the sun to rise, or set, simultaneously to any two places, he must, *at that moment*, be in the pole of a great circle passing through those places." So that, according to Mr. Nelson's supposition, the sun must remain immovably fixed in the equinoctial for the space of twelve hours.

It is true that Mr. Nelson, at the end of his communication, at page 248, slightly notices the difficulty that would arise from the change of declination; but this only renders it the more surprising that he should imagine, that, in a subject professedly treated *theoretically*, such change should *not* be rigidly taken into account. In fact, it was mainly to illustrate *it*, that the question was incidentally proposed; and if capable of no other answer than that given by Mr. Nelson, it would have been worse than ridiculous.

NAUTILUS.

January 13, 1840.

MR. SAMUEL HALL'S NEW PADDLE-WHEEL.

Since our last publication we have had an opportunity of personally inspecting a model of the "reefing paddle-wheel," referred to in such approving terms in the extract which we gave from the *United Service Journal;* and it gives us pleasure to be able now to state, not only that we entirely concur in the favourable opinion expressed of the wheel by our esteemed contemporary, but that it differs essentially from that of Mr. Holebrook (though the objects effected by it are similar), as well as from every other paddle-wheel which we can call to our recollection. The specification of Mr. Hall's invention not having been as yet enrolled, we do not feel at present at liberty to say more of it, than that it accomplishes, in our judgment, the important purpose aimed at—namely, the reducing and enlarging of the circle described by the paddle-boards, according to the degree of immersion of the vessel, in an exceedingly efficient manner by means of great ingenuity, simplicity, and novelty. It is proper to add, however, that the term *reefing* is calculated to convey rather an erroneous idea of the means employed; for the paddle-boards, though drawn in and pushed out at pleasure, present always the same amount of opposing surface to the water.

MR. RENNIE'S EXPERIMENTS ON PROPELLERS.—REPLY TO MR. HOLEBROOK'S REMARKS.

Sir,—The last number of your Magazine contains a communication entitled "Remarks on Mr. Rennie's comparative Experiments on Propellers." In it the author rather hastily attempts to show that certain conclusions proposed in the article which he reviews are "of no value whatever in the way of comparison of the useful effects of the different propellers." Having assisted in observing some of the results which Mr. Rennie has communicated, I may be allowed to offer a few words on the criticisms they have called forth.

In most points Mr. Holebrook has not been very successful in his conjectures as to what the true conditions of experiment were, which makes it to be regretted that these in one or two instances were not more exactly and explicitly stated. As the greater part of his reasoning is therefore founded on misapprehension, so far it becomes of "no value whatever" however correct in itself.

Referring to the manner in which the different floats were respectively treated in the experiments of the first table two suppositions are made, but neither of them correct. Further misconception in this matter may be prevented by explaining that the trapezium floats were placed with their greater diameters in the direction of depth—that the "dimension of wheel" is its extreme diameter—and that the depth of immersion was varied to give the quantities belonging to the third column. The experiments are selections from many made under a variety of conditions; and because of the less leverage that was given in them to the centre of pressure of the trapezium float, they exhibit the performance of *that* float in the least favourable manner. The mistake which is supposed to occur in the statement of the area of floats immersed, is very evident. The figures 12 and 9 in the second case ought to have been written 30 and 14. And the depth of immersion for both kinds of paddles in the same case ought to have been stated as 5¾ inches.

There follows an argument to prove *how the fact that* "different immersions *of the two wheels* produce very different results" is natural enough when the trapezium floats revolve in a *larger* circle; but it is so also when they revolve in an *equal* circle. Besides, any argument of this kind was hardly necessary, there having been no attempt to make results appear unnatural or mysterious.

The two conclusions appended to the first table are next reviewed. These conclusions, it should be remarked, are only an abstract of what was exhibited in the particular cases investigated, and not intended to be the expressions of general laws. It is apparently with the view of suiting them for general application that Mr. Holebrook proposes an amendment to each of them. The first amendment is too like an axiom to allow of discussion; and the second is too useless to require it, failing, as it does, to form a proposition in the least degree more capable of general application. The admission, moreover, of one amendment or other, will not, as is affirmed, render either conclusion "altogether useless." It is surely of use to show that while other advantages are gained by modifying the form of float, the wheels' resistance or its hold on the water is not sacrificed; and again that its liability to be injuriously affected by varying depth of immersion, is lessened. Such uses are served by the figures contained in the first table, and by the "conclusions" which express the same results in words.

A paragraph is next expended in the effort to demonstrate that it is not to the float's form that the fact is attributable, which has just been alluded to, namely, the less liability of the trapeziums to be injuriously affected by unusual immersion. But to use the reviewer's own words on another occasion, "a few circles drawn, and a trifling degree of reflection" might verify the fact, and show that a wheel with trapezium floats *may* have its immersed area increased in a less proportion than one with rectangular floats and of equal diameter, by an equal addition to its "dip."

The remarks in the succeeding paragraph are made to show that what was stated in reference to the first experiments is not exactly true in other cases. They will however appear uncalled for when it is considered (as has been already stated) that conclusions applicable to the first table are not intended

invariably applicable to all circum-es.

ur correspondent in summing up is point his preceding argument, s, "that he has said enough to that under equal conditions of ex-ent the trapezium floats do not re- the same resistance from the water is received by the rectangular ." Conclusions of this kind some- require more than verbal demon-on; and when the testimony of di- experiment is given, it must be ted as superior evidence. He not to have been aware that it is , however remarkable, and one not tly discovered, that a plane surface pezium form, presenting consider-*less* area than a like surface of rect-ar form, will encounter an equal ance in passing through a fluid.*

suppose that there is no difference manner of obtaining resistance in rew and conoidal propeller, is not t; and the deduction to which the sition leads, "that the screw would a vastly superior effect over the d," cannot be warranted. The d surface of the latter is so unlike rew that such a comparison in re- of inclination, as Mr. Holebrook make of the two, is not admis- But without further reasoning, amination of the first and second iments in second table sufficiently that almost the same exertion of obtains a much higher useful by the conoid than by the screw, kinds of apparatus working within limits. It may here be proper to our critic that the screw had no than one turn.

rly two columns are next occupied servations intended to show that the s of the second table, though cor-are "of no value whatever, because onditions under which they were ned, were not those most suited to a good comparison of the effectiveness of the different propellers employed." That they would be of little value indeed, is readily granted, had the conditions been as is supposed; but these have been unfortunately mistaken. The numbers given for floats and area immersed, are (as might be naturally expected,) *total* quantities. When six floats are spoken of the whole number in action is meant—three only for each wheel—the very number Mr. Holebrook prescribes, and with which he seems to predict the attainment of "vast superiority," by the wheel over the propeller. This explanation must at once set aside the objection that is urged against the results of Table II., as being useless in the way of comparing the performances of the several instruments.

In the first conclusion, annexed to the last table, "one-third" is an error which appears by an examination of the dimensions given to the floats. It ought to have been one-half, for $11\frac{1}{2}$ is $\frac{23}{2}$. By "width" is to be understood the horizontal dimension of the float; on this account it is a mistaken correction which the author of the "remarks" makes on this point. He attentively examines the table, and finds very little inferiority in the performance of the trapezium floats, but fails to remark that the same has been accounted for in a note, by the reduction, unavoidably made, of the area which had been prescribed for the float in question, in accordance with previous experience, and with the design of obtaining equal results in both descriptions of wheel. The conclusion of his examination of this table is, that "had the rectangular floats been made to revolve at the same distance from the shaft, we should have seen very different results in the resistance of the water against them." In one sense the floats did revolve at the same distance from the shaft, for their inner extremities were placed alike; but by this arrangement the centres of pressure were necessarily at different points. If the object of the conclusion is just to affirm, that had these centres coincided instead of not coinciding, that is, had circumstances been different, the results would have been different too, there will be no hesitation in acquiescing in anything so axiomatic, while it is maintained that by doing so nothing is retracted

* e *Philosophical Transactions* for 1831, page ere it is stated that though the area of a was diminished one-fourth by the removal orners, its resistance in moving through a mained the same. This has been corrobo-y the present paddle-wheel experiments, have shown that rhomboidal and rectan-oats, the centres of which were equally dis-m the wheel's centre, and their areas in the ion of 1 to 2, took respectively 10·25 and conds to permit the same weight to pass the same space; showing that a rhomboi-ace *half* the area of a rectangular one offers *o-thirds* the resistance.

which has been advanced as properties of the trapezium wheel.

The mistake about the width of floats already spoken of, is the basis of some observations which Mr. Holebrook offers in reference to the diminution of size and cost of the paddle-wheels and boxes, and renders them inapplicable. Nothing need be added to show in what respect the few words upon trapezium floats, which close the article, are inaccurate. The experiments quoted in a foregoing note make this sufficiently obvious.

The strictures on Mr. Rennie's experiments have now been severally noticed, and the attempt made (not without success it is hoped,) to parry the aim of your correspondent's remarks. As regards the paddle-wheel, he seems to write under the false supposition that the chief object of adopting trapezium-shaped floats, was to obtain superior resistance from a given area; this end is certainly accomplished. However, other advantages are mainly sought, and in such a way as not to be at the expense of resistance. The obvious tendency of the "remarks" is to throw discredit upon Mr. Rennie's experiments, by making it appear that they were not conducted with impartiality, and as if those cases only were exhibited which favoured wished-for conclusions. An appeal to the *various* conditions of the several sets of experiments may fully refute the allegation; for let it be observed, that in comparing the different wheels their diameters were equal, first, when measured to outer extremities (as in Table I.), then when measured to centres of pressure (as in Table II.), and, lastly, when measured to exterior extremities of floats (as in Table III). Could more diverse methods have been used better to test the comparative qualities of the subjects of experiment?

It may contribute to remove Mr. Holebrook's difficulties, or those of any other reader who may feel equally sceptical on the subject, to attempt a *re*-explanation of what are considered to be the properties and advantages of the new wheel in comparison with one of ordinary description.

In the new wheel a modified form is given to the float surface, which, while it has the remarkable quality of offering a *superior resistance* in proportion to its *area, greatly facilitates* the acts of immersion and emergence, consequently subdues in a like degree the violence of those impulses which usually set every part of a steamer in vibration, and effects no small reduction in the amount of backwater; again, from the nature of the float's area, the performance of the wheel becomes less subject to injury from undue immersion. The diminished width of wheel occasions a diminution in its weight and cost, and thereby the paddle-boxes are so much reduced that, generally, there would be saved about one-half of their areas directly exposed to the influence of the wind, and by the pointed form of the surfaces which remained, their adverse effects would be further obviated. As it is to be supposed that the diminished dimensions of the floats renders a reduction of the spaces between them admissible, it is proposed to furnish the new wheel with a greater number of paddles than would be given by present practice to a wheel of equal diameter. Hereby the double advantage is gained of adding to the resisting surface, and of promoting in a still greater degree the continuous action of the wheel.

The length to which I have trespassed on your columns needs some apology. The extended nature of the communication to which I reply, has obliged me to say so much. In the hope that you will take the earliest opportunity of inserting the above,

I remain, Sir,
Your obedient servant,
J. M.

January 9, 1840.

ON MACHINERY CONSIDERED IN RELATION TO THE PROSPERITY OF THE WORKING CLASSES.* BY M. ARAGO.

[From the *Edinb. New. Phil. Journal*, translation.]

Many individuals, without questioning the genius of Watt, regard the improvements on account of which the world is his debtor, and the great impulse they have given to the

* In writing the following chapter, I thought that I might avail myself without scruple of the numerous documents I have collected, whether in my occasional intercourse with my illustrious friend Lord Brougham, or in those works which his Lordship has published, or which have appeared under his patronage. Were I to believe the criticisms which various persons have published since the reading of this eloge, I have, in endeavouring to combat the opinion that machinery is injurious to the working classes, been attacking a worn-out prejudice which has no longer any real existence.

s of industry, as a social calamity. we to believe them, the adoption of new machine inevitably increases the eniences, and adds to the miseries of tisans. All those wonderful mechani- mbinations which we are in the cus- admiring for the regularity and har- of their movements, and for the energy elicacy of their effects, are, in their n, only instruments of evil, which the tor ought to proscribe with a just and able severity.

nscientious opinions, and especially ssociated with feelings of philanthropy, ever have a claim to attentive examina- Nay, I will add, that from me such an nation is an imperative duty. I should, , neglect that aspect of the labours of ustrious associate which is most worthy lic admiration, were I not, far from ibing to the criticisms of prejudice, to ip such labours to the attention of f property, as the means the most ful, the most direct, and the most ef- us for relieving the operatives of their t sufferings, and for making them par- e in all the blessings which appeared the peculiar inheritance of the rich.

en we have to make a choice between opositions which are diametrically op- to each other—when the one being he other must necessarily be false, and nothing, at the first glance, seems to te a rational choice between them, tricians are in the habit of taking up contrary propositions, of following out minutely through their several cations, and so arriving at their ulti- logical results; and the proposition is incorrect, and it alone, seldom by this process to lead to conse- es which a correctly constituted mind t admit. Let us employ for a mo- this method of examination, of which l so often availed himself, and which justly termed the *reductio ad ab- m*.

opponents of machinery would anni- it, or at least would greatly restrict ployment, to preserve, they say, more work for the labouring classes. Let us for a moment adopt this view, and we shall find that the anathema extends far beyond machines properly so called.

And we must begin by taxing our ancestors with the greatest improvidence. If, instead of founding the city of Paris, and continuing to extend it on both banks of the Seine, they had built it upon the plain of Villejuif, then, for ages, the corporation of water-carriers would, of all others have been the best employed, the most necessary, and the most numerous. The political economists, therefore, with whom we are now contending, should consult the interests of these water-carriers. To divert the Seine from its course is by no means an impossibility; they should, therefore, propose the accomplishment of this great work—they should open a subscription to divert the river from Paris; and the general laugh would then teach them that the method of the *reductio ad absurdum* is not without its use even in political economy; and the workmen themselves, in their right senses, would tell them that it is the river which has created that immense capital where they find so many sources of occupation, and that without it, Paris would probably still have been only another Villejuif.

Up to the present time, the Parisians have always been congratulated upon their proximity to those inexhaustible quarries, whence, for many generations, have been procured the materials employed in the construction of their temples, their palaces, and their private dwellings But all this is mere illusion! The new political economy will prove to us, that it would have been eminently advantageous had all our stone and lime been found no nearer than Bourges, a distance of 120 miles. In this case, count upon your fingers, if you can, the number of workmen, whose employment would have been necessary, to convey to the stone-yards of the capital, the stones which the builders have required for five centuries, and you will obtain a prodigious result; and however little satisfied you may be with novel ideas, yet you may rejoice to your heart's content upon the delight which such a state of things would create among the day labourers!

The capital of a powerful kingdom, not very distant from France, is traversed by a majestic river, which even ships of war ascend in full sail. Innumerable canals in all directions intersect the surrounding country, and transport, at little expense, packages of the largest bulk. A complete net-work of excellent roads, most admirably kept, leads to the most distant parts of the country. In addition to these great gifts of nature and of art, the capital enjoys, what every one must

I believe this to be the case, I would wil- suppress all my reasonings, good or bad. fortunately, the letters which worthy work- requently address to me, whether as Acade- or Deputy, and still more the dissertations *fesso*, and quite recent, of several political nists, leave me no doubt as to the necessity of ng now, and of repeating upon every be- g occasion, that machinery has never been the use of the sufferings of one of the most nu- s and interesting classes of society; that its ction would only aggravate suffering; and is not in this quarter we shall find the re- for evils, which I *regret from the bottom of* *art*.

now call *an advantage* of which Paris is deprived, for the stone-quarries essential to building are not in its vicinity, but are found only at a distance. Here, then, is the Utopia of the new economists realized. They may now calculate the hundreds of thousands, nay, the millions of quarrymen, boatmen, carters, and stone-cutters, who must unceasingly be occupied in raising, transporting, and preparing all the variety of stones which are required in the construction of the immense number of buildings, which are every year added to this great metropolis. But stop! they may spare their pains, for it happens that in this city—as it would happen in Paris, deprived of its rich quarries—that stone being very expensive, is not used, and brick is everywhere substituted in its place.

Thousands of workmen every day execute at the surface and in the bowels of the earth prodigious labours, which it would be necessary totally to abandon, if certain machines were relinquished. One or two examples will suffice to make this truth sufficiently apparent. The daily removal of the water which rises in the galleries of the Cornish mines requires a power of fifty thousand horses, or of three hundred thousand men. I ask if the wages of three hundred thousand workmen would not absorb all the profits which the mining operations might produce? But the question of wages and profits may touch a tender point; and therefore I turn to other considerations, which, however, lead to the same conclusion. A single copper-mine in Cornwall, one of those known as the *Consolidated mines*, requires a steam-engine of the power of more than three hundred horses constantly at work, and thus every twenty-four horses realizes the labour of one thousand hours. Concerning this, the assertion cannot be doubted, that no means could possibly be found beneficially and simultaneously to apply the strength of more than three hundred horses, or two or three thousand men, around the mouth of the shaft of the mine. To proscribe, therefore, the action of the steam-engine of the *Consolidated mines*, would be to reduce to a state of inactivity a great number of workmen whose labours are now rendered available; it would be to declare that the copper and tin mines of Cornwall must for ever remain buried under a mass of soil, rock, and liquid, many hundred yards deep. The proposition, brought to this form, could certainly have few defenders; but the form is nothing, whilst the substance remains the same.

If, from operations which require the *greatest developement of* power, we turn to *the examination of different products of* industry whose delicacy of parts and regularity of form have ranked them among the wonders of art, the insufficiency, and even the inferiority of our organs, compared with the ingenious combinations of machinery, are equally striking to all. Where, for example, is the skilful spinner who, from a single pound of raw cotton, could produce a thread one hundred and fifty miles long, as can the mule-jenny?

I am not ignorant of what certain moralists have said about the uselessness of muslins, laces, and tullies, which these slender threads are employed to manufacture; but I need only remark, that the most perfect *mule-jennies* require the continued superintendence of a great number of workmen; that the only object with them, is to manufacture productions which will sell; and that, finally, if luxury be an evil, a vice, or even a crime, it should be ascribed to the buyers, and not to the poor workers, whose means of existence, I believe, would he hazarded, if they employed their strength in making for the ladies, course stuffs, instead of fashionable tullies.

Let us now, however, leave these details, and come to the essential merits of the question. "We must not," said Marcus Aurelius, "receive the opinions of our fathers, as do mere infants, for the simple reason that our parents held them." This assuredly just maxim should not at the same time prevent us from thinking, or, at all events, from presuming, that those opinions, concerning which no objection has been raised sincethe origin of society, are conformable both to reason and general interest. Well, then, upon the opinion so much debated concerning the utility of machinery, what were the unanimous sentiments of antiquity? Its ingenious mythology will inform us. The founders of empires, the first of legislators, the conquerors of those tyrants who oppressed their country, received the qualified title of demi-gods; and it was among these same gods that were placed the inventors of the spade, the sickle, and the plough.

But instantly, I hear some of our adversaries declaiming about the extreme simplicity of the instruments I have cited,—refusing them the name of machines,—designating them mere tools, and obstinately entrenching themselves behind this distinction. To this we might reply, that such a distinction is puerile; and that it is impossible to say with precision where the tool ends, and the machine begins. It is of more importance, however, to remark, that the murmurers against machines have never said one word of their greater or less degree of complication. If they reject them, it is because, by their means, one workman per-

forms the the labour of many; and will they venture to maintain that a knife, a gimlet, a file, or a saw, does not give a marvellous facility of action to the man who uses them; and that his hand, so supplied, can do the work of many hands armed only with their nails.

Those labourers were not arrested by this sophistical distinction between tools and machinery, who, seduced by the execrable theories of some of their pretended friends, ran through certain counties of England, in the year 1830, vociferating *Death to machinery!* Rigorous logicians, they broke the sickle in the farm-yard, destined for reaping, the flail employed in thrashing, and the sieve with which the grain was cleaned. Who can deny, that the sickle, the flail, and the sieve are, in truth, means for abridging labour? Not even the spade, pick-axe, plough, and driller, found favour with this blind herd; and, if one thing in the history of this mania astonished me more than another, it was, that they spared the horses, which, in reality, are a kind of machines, kept up comparatively at a cheap rate, each of which daily executes the work of six or seven labourers.

Political economy has now happily taken its place among the sciences of observation. The experiment of the substitution of machinery for manual labour has now so frequently been resorted to, that we can draw general results, though not, perhaps, quite free from accidental irregularities. These results are as follows:—

By saving the labour of man, machinery effects a reduction in price. The effect of this reduction is increased demand; and to such an extent, so great being our desire to improve our condition, that, in spite of the almost inconceivable reduction of price, the pecuniary value of the total merchandize produced, every year surpasses what it was previous to the introduction of these improvements, and the number of workmen which these employments require, *increases* with the introduction of the means of more rapid fabrication. This last result is precisely the opposite of that which the adversaries of machinery predict. At first sight, the fact appears paradoxical; but, notwithstanding, it is demonstrated beyond dispute, by an examination of the most satisfactorily determined results.

When, three centuries and a half ago, the printing-press was invented, copyists supplied books to the very small number of the wealthy who could afford this very expensive gratification. A single individual of these copyists, by means of the new invention, being able to accomplish the work of two hundred, they did not fail at the time to characterize it as an *infernal* invention, which, in a certain class of society, would reduce to beggary nine hundred and ninety-five persons out of every thousand. Let us compare the actual results, with this sinister prediction.

Manuscript books were little in demand; printed books, on the contrary, on account of their very low price, were sought after with the greatest avidity. The great works of the principal Greek and Roman authors required to be reproduced unceasingly. New ideas and new opinions gave rise to a multitude of works, some of an enduring interest, whilst others were called into existence by passing events; so that, it has been calculated that, in London, previous to the invention of printing, the trade in books afforded occupation to about two hundred individuals, whereas, now, there are, *engaged in it, tens of thousands*. And what would be the result, if, laying aside the restricted and, so to speak, the *material* view of the subject, we regard printing in its moral and intellectual aspects; if we examined its influence upon public manners, upon the diffusion of knowledge, and the progress of the human mind; if we could count the number of volumes for which we are indebted to it, which the copyists would certainly have despised, but from which genius daily draws forth the elements of its best and most pregnant conceptions? However, I must not forget that the question before us regards the number of workmen employed in the different branches of industry.

The manufacture of cotton presents us with results still more remarkable than those of printing. At the time when an ingenious barber at Preston, by name Arkwright, who left a fortune of about one hundred thousand pounds a-year to his children, rendered the substitution of turning rollers for the spinners' fingers, useful and profitable, the annual product of the cotton manufacture of England did not amount to more than 2,000,000*l*., now it exceeds 37,000,000*l*. In the county of Lancaster alone, there is delivered, every year, to the manufacturers, a quantity of cotton thread, which twenty-one millions of expert spinners could not prepare by means of the spindle and distaff. Now, although, in the art of preparing this thread, mechanical means have been carried to their extreme limits, a million and a half of workmen find daily employment, where, previous to the inventions of Arkwright and Watt, there were not fifty thousand employed.*

* Mr. Edward Baines, the author of an esteemed work upon the history of the cotton manufacture in Britain, has had the singular curiosity to calculate the length of the thread, which is annually employed in the fabrication of cotton goods, and

A certain philosopher has exclaimed, Nothing new is now published, unless that which has been long forgotten be called such. If he intended his remark to apply only to old errors and prejudices, there would be some point in it; for all ages have been so fertile in this way, that no one can now have the advantage of priority. For instance, the pretended philanthropists of our day have not even the merit (if merit there be) of having invented the system I am now examining. For behold poor William Lea exhibiting the first stocking frame in the presence of King James I. The mechanism appeared admirable; why then reject it? Simply from the pretext, that the working classes would suffer. Nor was France a whit wiser than England. Lea found no encouragement there, and he died in an hospital, like so many other men of genius who have had the misfortune to advance beyond their age.

It should here be observed, that a person would very much deceive himself if he supposed that the stocking-knitters, of whom William Lea thus became the victim, were a numerous body. In the year 1583, none but individuals of high rank and large fortune wore stockings. The middle classes, instead of this part of our clothing, wore tight bandages of various stuffs. The rest of the population, that is to say, nine hundred and ninety-nine out of every thousand, went bare-legged. Now, on the contrary, out of a thousand individuals, there is not perhaps more than one who is not able, owing to their extreme cheapness, to provide a pair of stockings. And hence, an immense number of workmen in all countries, are engaged in this kind of manufacture.

Were it at all necessary, I might add, that, at Stockport, the substitution of steam for the labour of the hands in the manufacture of lace, has increased the number of workmen engaged in this branch of manufacture, and this is to the extent of one-third, in a very few years.

We must now, finally, drive our adversaries from their last retreat, for they must not be allowed to say, that we have adduced our proofs solely from antiquated subjects of human industry. We accordingly remark, that their lugubrious anticipations respecting the recent engraving on steel, were not a whit less wide of the mark. A copper-plate, they observed, cannot produce more than two thousand impressions. A steel plate, which can supply a hundred thousand, without wearing, will supplant fifty copper-plates. The plainest arithmetic, therefore, they contended, demonstrates that the majority of engravers (forty-nine out of the fifty), will be forced to leave their benches,—to throw away their graver for the trowel and the pick-axe, or to implore charity on the public ways. For the twentieth time we beseech you, anticipators of evil, to remember the principal element of the problem ye pretend to solve!—consider the insatiable desire of wellbeing which nature has implanted in the heart of man;—think that the gratification of one want, whets the appetite for the satisfaction of another, that our desires increase with the cheapness of the supply which supports them, and to such an extent as to defy the creative energies of the most powerful machines.

But to return to engravings. The immense majority of the public never thought of them when they were dear, and when cheap, they are in universal demand. They have already become the ornaments of our best books, and they confer on second-rate works the best prospect of sale. Even in our almanacks, the antique and hideous representations of Nostradamus and Mathieu Laensberg have given place to picturesque views, which in a few seconds transport our immoveable citizens from the banks of the Ganges to those of the Amazon, from the Himalayas to the Cordilleras, from Pekin to New York. Behold too, the poor engravers whose ruin was so piteously foretold. They were never so numerous—never so well employed.

All these are unanswerable facts, and from them one consequence most assuredly does *not* follow; viz. That in the world we live in among its inmates, such at least as nature has created them, the employment of machinery diminishes the number of workmen required in the several branches of industry. With other habits, manners, and passions, a different conclusion *might* be reached; but the probabilities on this supposition may be left to be wrought out by those who speculate upon the domestic economy of the inhabitants of the Moon, Jupiter, or Saturn,

Confined within much narrower limits, I inquire—If, after having thus sapped the very foundation of the system of the opponents of machinery, it be at all necessary to glance at some minor points, which have been mixed up with the consideration of the subject? The Poor Law of England is the most important of these: but, from this bleeding wound, the nation has suffered since the days of Queen Elizabeth; and surely it is absurd to ascribe to the abuse of machinery, an evil which took its origin, and

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has found that the total length equals fifty-one times the distance of the sun from the earth (fifty-*one times thirty-nine millions of* leagues), or about *two thousand millions of* leagues.

luxuriated for ages, before the labours of Arkwright and Watt were ever heard of. But you must concede, it will be answered, that the steam-engine, and the mule-jenny, and the carding machine, and the printing press, &c., these objects of general predilection, have at all events aggravated and extended the evils of pauperism? Far from it. For what are the facts? First of all, machinery has never been represented as a universal panacea. It has never been alleged that it possessed the unheard of power of dispelling error and passion from political assemblies; that it could direct the counsellors of princes in the paths of moderation, wisdom, and humanity; that it could have prevented Pitt from unceasingly intermeddling with the affairs of other countries—from every year resuscitating, in all quarters of Europe, the enemies of France,—from subsidising them with immense sums, and thus overwhelming England with a debt of hundreds of millions. This is the cause why the poor law tax has so rapidly and so prodigiously increased. Machinery has not, and could not produce the evil. On the other hand, it has done much to moderate it, an assertion which may be proved in few words. Lancashire is the most manufacturing county of England. In it are situated the towns of Manchester, Preston, Bolton, Warrington, and Liverpool. Here, we say, machinery has been most rapidly and most generally introduced; and with what effect? If we compare the total annual amount of the poor law tax in Lancashire, with the amount of that raised throughout the country, and ascertain the share of each individual, we find that in this county it amounts to only one-third of the mean paid in the other counties. These cyphers, then, give no quarter to the allegations of system-makers.

Nor should the high-sounding words so often used by certain declaimers about the poor laws, induce us to suppose that the labouring classes among our neighbours are wholly deprived of forethought and resources. A publication of very recent date has shown that, in England alone (Scotland and Ireland being omitted), the capital belonging to operatives in the savings banks now amounts to about sixteen millions sterling! And the results observed in the principal towns are not less instructive.

There is one principle which has remained uncontroverted, amidst the animated controversies to which the science of political economy has given birth, viz., that population increases with general prosperity, and rapidly diminishes in times of wretchedness.*

Now, let us place facts in juxtaposition with the principle. Whilst the mean population, during the last thirty years, has augmented in the ratio of 50 per cent., Nottingham and Birmingham, two of the most manufacturing towns, exhibit increments of 75 and 90 per cent. Finally, Manchester and Glasgow, which occupy the first rank in the British empire, for the number, size, and importance of the machines they employ, in the same period of thirty years, have seen their population augment 150 and 160 per cent.; an amount three or four times greater than in the agricultural counties, and in those towns which are not manufacturing. These figures speak for themselves, and there is no sophistry, or false philanthropy or eloquence, that can resist them.

One chief objection brought against machinery I cannot disregard. At the moment that new improvements are introduced, and when by their means manual operations are very extensively superseded, certain classes of workmen suffer from the change;—their honourable and laborious industry is annihilated at a blow; and those who, according to the previous method, were the most expert and deserving, being deficient of the qualifications which the new plan requires, are thrown out of employment, and can but rarely find other means of subsistence. These reflections are just, and I may add, that the melancholy consequences to which they refer, must frequently occur, for the mere caprices of fashion often in this way produce extensive wretchedness. If, then, I do not hence conclude that the world remain stationary, but still desire advancement in the general progress of society, I am far from maintaining that we should be indifferent to the individual sufferings, of which this progress is the momentary cause. The authorities, always watching for new inventions, seldom fail to reach them with their fiscal regulations. Would it be too much to ask, that the first contributions levied on the successful exercise of genius, should be appropriated to the opening of spacious workshops, in which the workmen deprived of employment might for a time find occupation suitable to their powers and intelligence? This course has sometimes been followed with success, and why should it not be generalized? Humanity demands it as a duty; sound policy dictates it; and, were other inducements necessary, sad events, whose history is not yet forgotten, strongly recommend it on economical grounds.

To the objections of the theorists, who apprehended that the progress of machinery would reduce the working classes to a state of total inactivity, have succeeded difficulties of quite a different character, on which it

* To this general rule *Ireland is an exception; the cause of this, however, is well known.*

seems indispensable we should for a few moments dwell.

By superseding, in our manufactories, every exertion of great masculine strength, machinery permits the introduction of a great number of children of both sexes; and the cupidity of their parents has a tendency to abuse the opportunity. The hours of labour are made to surpass all bounds; and, for the daily bait of a few pence, minds, which education would enlighten, are sacrificed to enduring brutalization, whilst the bodily frame is blighted for want of that development which the enjoyment of the air and sun rarely fails to bring along with it. Under these circumstances, to insist that the legislature should put a stop to this shameful oppression—to urge forward measures calculated to contend with the demoralization which is the usual consequence of numerous meetings of the young persons employed—to endeavour to introduce, and multiply in our cottages, various implements, by which, according to the season, the labours of agriculture might be associated with those of the artisan, this would be patriotism and humanity, this would be to understand and supply the real wants of the working classes. But, on the other hand, to persist that the vast labour, which machinery can effect in a moment, and cheaply, shall be performed, at a great price, by the toil of man's hand and the sweat of his brow—to assimilate the workman to the brute—daily to require from him exertions which ruin his health, and which science can obtain to the extent of a hundredfold, by means of wind, and water, and steam, this would be to recede from the grand object we have in view. It would be to abandon the poor to nakedness; to reserve a thousand enjoyments exclusively for the rich which are now common to all. It would be, in short, to return again to the ages of ignorance, barbarity, and wretchedness.

AMERICAN AMALGAMATION—SAVING OF MERCURY. BY J. PRIDEAUX, ESQ., F.G.S.

[*From the Mining Review.*]

Having had occasion, some years since, to examine the American process of amalgamation, with a view to devise means of reducing the heavy loss of quicksilver, and the investigation having been deferred, partly by other occupations, but partly also by the publication of the same principle by M. Dumas ("Chimie des Arts," tome iv., p. 358), my attention was recalled to the subject last year, by a friend in frequent communication with American silver companies, and I am rather surprised that M. Dumas' suggestion does not appear to have been acted upon.

The quicksilver is consumed in the process, in detaching the silver from its combinations, the excess remaining in amalgam with the silver reduced. This consumption, though variously estimated, probably exceeds 1,000 tons per annum, in America alone. Such a waste appears unnecessary, whilst we have other metals of stronger electro-positive affinities than quicksilver; at once much cheaper, capable of easy amalgamation, and as easily separable from the silver when employed in excess. These qualities are important, as the silver reduced in fine powder, dispersed through the torta, might be washed away; but reduced by an amalgam, by double decomposition, the mercury will cause the particles to cohere, and the excess of reducing metal must be separated so as to leave the silver unimpaired.

Of these *lead* is the most nearly related to silver, not only in its natural repositories, but in its properties, being classed, by M. Ampere, amongst the Argyroides. Not only does it very easily amalgamate with mercury, but the amalgam readily decomposes chloride of silver in the humid way, by double decomposition, into chloride of lead and amalgam of silver, and the residue of lead is easily got rid of by cupellation. No other metal, so far as I am aware, answer all these purposes so completely; and the same idea occurred to M. Dumas, though he does not seem to have experimented upon it. He says—"Il est bien vraisemblable, que si le mercure employé renfermoit en plomb, un poids egal a celui de l'argent qu'il faut extraire, le plomb agiroit chimiquement sur les composes d'argent, pour le mettre en libertè, et empareroit du chlore ou du souffre avec lesquels il est combiné. Le mercure et l'argent, devenus libres l'un et l'autre, fourniroit l'amalgame d'argent que l'on cherche a produire."

Now the amalgam must be distributable throughout the torta, in fine globules or particles, as the mercury is, by squeezing through a cloth, whence it is shed upon the argentiferous slime like dew, and is then trodden in by mules. But lead will not dissolve, liquid, in quicksilver, in sufficient proportion for the purpose—say 1 to 6; and bismuth, of which a small addition will effect this, is much too scarce. Tin, with lead and mercury in proper proportions, will form an amalgam, strong enough of the baser metals, and liquid enough at 95 deg. to be squeezed through canvas; but this seems to act too rapidly upon the magistral, and does not save so much mercury as an amalgam of only lead.

The most effective process, in my experi-

ments, was, to employ a solid amalgam of lead, powdered fine, and dusted on with a sieve before sprinkling on the mercury.

These experiments were on a very small scale, with chloride of silver, mixed up with earthy and other ingredients, in imitation of a torta. To prevent completely the consumption of quicksilver an excess of lead was used, and, in one instance, the whole of the silver was recovered, without any loss of mercury. In general, the more complete the recovery of silver, the less quicksilver was lost. Although it be not certain that in patio the operation is chiefly on chloride of silver, it being only the theory drawn from reasoning on the wet reaction in mass of sulphate of copper, chloride of sodium, and sulphurets of silver with other metals; yet this mode had the advantage of making known the exact quantity of silver present, without the possible errors of assay, whilst small laboratory experiments, even on the identical ores, would not be received as definitive proof of success in patio, under practically skilful, but, perhaps, unscientific management. Such evidence would still have to be obtained in "guia," the guide heaps kept in advance to direct the operator in his proceedings.

In these little experiments, three parts of lead were used for the extraction of two of silver. The lead was melted, three-fourths its weight of quicksilver mixed in, and the amalgam powdered before quite cold, whilst least cohesive. It was immediately dusted over the little torta. One-half the quicksilver was then sprinkled on through a fine cloth, and well worked into the slime. The proportion thus sprinkled on, before mixing, will depend on the relative extent of surface. The globules should attach themselves to the particles of amalgam, to give cohesion to the reduced silver; but they must not run together too much for effective distribution throughout the torta.

The examination of progress cannot be made by the degree of solidity of limadura as when pure quicksilver is employed, because they derive initiatory solidity from the lead. A portion of them must be collected and weighed, and then cupelled, either in the muffle or by the blowpipe, when the residue of silver will indicate precisely the progress of reduction. The amalgam is much less tardy than pure mercury, so that the second half of the mercury might always be added a few days after the first. Indeed, I am not aware that any disadvantage resulted from adding the whole at first, taking care to mix one portion well in before adding another, that the globules should not run too much together; on the contrary, when the slime was made very poor in silver, this seemed rather *advantageous.*

As to the total quantity of mercury, a general rule is 6 to 1 silver, but this is subject to certain variations. With the amalgam of lead a full proportion of mercury answers best, and does not, in the small way, at least, occasion any loss.

An addition of zinc rendering the amalgam pulverisable with a larger proportion of mercury, would facilitate its more complete distribution throughout the torta; but tin having appeared to act too rapidly on the magistral—an inconvenience likely to occur in an increased degree with zinc—I did not put it to the test of experiment. A less tender magistral, sulphate of iron, tried with this, did not give a better result, but the contrary. There is certainly yet room for a thorough investigation into the action and qualities of magistral—a subject which would abundantly repay the employment of the ablest metallurgical chemist.

The only inconvenience which occurred to me from the employment of the amalgam, with excess of lead, is in the distillation of the mercury. This being done "per descensum," a fusible amalgam of lead and silver sweats out, and runs down with the mercury, thus giving an apparent deficiency of produce the first time. This, however, does not happen if the distillation be ascending; and when it does occur, whatever cannot be strained off comes up again n the quicksilver, and goes to compensate the deficiency, from the same cause, in the next patio. It is never really lost, but the trouble of separating and calculating it would raise a question as to the amount of excess of lead to be used, or whether it would be better sacrifice a little quicksilver, to keep the produce of each torta separate.

GLASS MAKING.

[*From Ure's Dict. of Arts and Manufactures.*]

The following are receipts for making the different kinds of glass:—

1. *Bottle Glass.*—11 pounds of dry glauber salts; 12 pounds of soaper salts; a half bushel of waste soap ashes; 56 pounds of sand; 22 pounds of glass skimmings; 1 cwt. of green broken glass; 25 pounds of basalt. This mixture affords a dark green glass.

2. Yellow or white sand 100 parts; kelp 30 to 40; lixiviated wood ashes from 160 to 170 parts; fresh wood ashes 30 to 40 parts; potter's clay 80 to 100 parts; cullet or broken glass 100. If basalt be used, the proportion of kelp may be diminished.

In two bottle-glass houses in the neighbourhood of Valenciennes, an unknown ingredient, sold by a Belgian, was employed, which he called *spar.* This was discovered

by chemical analysis to be sulphate of baryta. The glass-makers observed that the bottles which contained some of this substance were denser, more homogeneous, more fusible, and worked more kindly, than those formed of the common materials. When one prime equivalent of the silicate of baryta = 123, is mixed with three primes of the silicate of soda = (3 × 77·6) 232·8, and exposed in a proper furnace, vitrification readily ensues, and the glass may be worked a little under a cherry-red heat, with as much ease as a glass of lead, and has nearly the same lustre. Since the ordinary run of glass-makers are not familiar with atomic proportions, they should have recourse to a scientific chemist, to guide them in using such a proportion of sulphate of baryta as may suit their other vitreous ingredients; for an excess or defect of any of them will injure the quality of the glass.

3. *Green window glass, or broad glass.*—11 pounds of dry glauber salt; 10 pounds of soaper salts; half a bushel of lixiviated soap waste; 50 pounds of sand; 22 pounds of glass pot skimmings; 1 cwt. of broken green glass.

4. *Crown Glass.*—300 parts of fine sand; 200 of good soda ash; 33 of lime; from 250 to 300 of broken glass; 60 of white sand; 30 of purified potash; 15 of saltpetre (1 of borax), ½ of arsenious acid.

5. *Nearly white table glass.*—20 pounds of potashes; 11 pounds of dry glauber salts; 16 of soaper salt; 55 of sand; 140 of cullet of the same kind. Another.—100 of sand; 235 of kelp; 60 of wood ashes; 1⅓ of manganese; 100 of broken glass.

6. *White table glass.*—40 pounds of potashes; 11 of chalk; 76 of sand; ½ of manganese; 95 of white cullet.

Another.—50 of purified potashes; 100 of sand; 20 of chalk; and 2 of saltpetre.

Bohemian table or plate glass is made with 63 parts of quartz; 26 of purified potashes; 11 of sifted slaked lime, and some cullet.

7. *Crystal glass.*—60 parts of purified potashes; 120 of sand; 24 of chalk; 2 of saltpetre; 2 of arsenious acid; $\frac{1}{16}$ of manganese.

Another.—70 of purified pearl ashes; 120 of white sand; 10 of saltpetre; ½ of arsenious acid; ⅓ of manganese.

A third.—67 of sand; 23 of purified pearl ashes; 10 of sifted slaked lime; ¼ of manganese; (5 to 8 of red lead).

A fourth.—120 of white sand; 50 of red lead; 40 of purified pearl ash; 20 of saltpetre; ⅕ of manganese.

A fifth.—120 of white sand; 40 of pearl ash purified; 35 of red lead; 13 of saltpetre; $\frac{1}{12}$ of manganese.

A sixth.—30 of the finest sand; 20 of red lead; 8 of pearl ash purified; 2 of saltpetre; a little arsenious acid and manganese.

A seventh.—100 of sand; 45 of red lead; 35 of purified pearl ashes; ¼ of manganese; ⅕ of arsenious acid.

8. *Plate glass.*—Very white sand 300 parts; dry purified soda 100 parts; carbonate of lime 43 parts; manganese 1; cullet 300.

Another.—Finest sand 720; purified soda 450; quicklime 80 parts; saltpetre 25 parts; cullet 425.

A little borax has also been prescribed; much of it communicates an exfoliating property to glass.

Tabular view of the composition of several kinds of Glass.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 9.
Silica	71.7	69.2	62.8	69.2	60.4	53.55	59.2	51.93	42.5
Potash	12.7	15.8	22.1	8.0	3.2	5.48	9.0	13.77	11.7
Soda	2.5	3.0		3.0	S. pot.				
Lime	10.3	7.6	12.5	13.0	20.7	29.22			0.5
Alumina	0.4	1.2		3.6	10.4	6.01			1.8
Magnesia		2.0		0.6	0.6				
Oxide of iron	0.3	0.5	2.6	1.6	3.8	5.74	0.4		
— manganese	0.2						1.0		
— lead							28.2	33.28	43.5
Baryta					0.9				

No. 1. is a very beautiful white wine glass of Neuwelt in Bohemia.

No. 2. Glass tubes, much more fusible than common wine glasses.

No. 3. Crown glass of Bohemia.

No. 4. Green glass, for medicinal phials and retorts.

No. 5. Flask glass of St. Etienne, for which some heavy spar is used.

No. 6. Glass of Sevres.

No. 7. London glass employed for chemical and physical purposes.

No. 8. English flint glass.

No. 9. Guinand's flint glass.

The manufacture of *glass beads* at Murano near Venice, is most ingeniously simple. Tubes of glass of every colour, are drawn out to great lengths in a gallery adjoining the glass-house pots, in the same way as the more moderate lengths of thermometer and barometer tubes are drawn in our glass-houses. These tubes are chopped into very small pieces of nearly uniform length on the upright edge of a fixed chisel. These elementary cylinders being then put in a heap into a mixture of fine sand and wood ashes, are stirred about with an iron spatula till their cavities get filled. This curious mixture is now transferred to an iron pan suspended over a moderate fire, and continually stirred about as before, whereby the cylindrical bits assume a smooth rounded form; so that when removed from the fire and cleared out in the bore, they constitute beads, which are packed in casks, and exported in prodigious quantities to almost every country, especially to Africa and Spain.

HUNT'S PATENT PROPELLING AND STEERING APPARATUS.

In our 852nd number we published a notice of a new invention recently patented by Mr. Hunt, engineer, of Greenwich, for propelling and steering steam vessels. A private company has been formed to put the plan to the test of practice, from the prospectus issued by which, we extract the following particulars:—

"The advantages to be obtained by the use of this machinery over the machinery used on board an ordinary steam vessel are, that the propelling power is fixed in the stern of the vessel, by which the paddle-wheels and paddle-boxes are entirely superseded, and the deck of the vessel will present the same uninterrupted surface, as that of an ordinary sailing vessel with the exception of the funnel, and at the same time the application of the machinery is such that it takes up less room than in an ordinary steam-boat; and the manner, in which it is placed, being longitudinally, admits of room for stowage in the sides of the vessel, by which the machinery gains greater protection than at present.

"The application of the steering power is singularly effective, and has attracted the admiration of all the scientific and practical men who have seen it. It requires scarcely any manual power to steer the vessel, and that too, whilst going at full speed; and its power is such, that the greater the speed, the more effectual and instantaneous is the effect of the steering apparatus over the vessel, an advantage which every one at all connected with steam-boats, will at once perceive to be invaluable; and unlike the rudder which acts by stopping the way of the vessel, the same power which here impels the vessel along, compels her at the same time to travel instantly in the very course desired. Another great advantage is, that by this apparatus, a steam-boat can go quite as fast a-stern as a-head, and the effect of the steering power will be the same; by which the difficulty so frequently complained of by the masters of steam-boats, that in the Pool they cannot always have steerage way on their boats to prevent them getting into danger, is entirely got rid of.

"Persons in the habit of travelling by steam-boats, have often suffered from the delay and inconvenience of the boat being 'put by,' as it is called, in a crowded Pool, and the boat being unable to move, onwards for a considerable time, for want of room she cannot get way on her to answer the helm. This is an inconvenience which can never happen to any vessel fitted with this patent apparatus. The steering apparatus acts so forcibly on the propelling power, as not to require that she should have any way upon her to give effect to the steerage power; she can as easily move a-stern as a-head, and if there is neither room to move a-head or a-stern, she can turn in her own length, so as to take advantage of any opening on either side.

"With regard to the speed of a vessel fitted with this apparatus, experiments have already proved it to be equal to that of steam-vessels fitted with the usual apparatus of paddle-wheels.

"In rivers and canals the advantage of this apparatus is incalculable; no swell whatever, is created; indeed from the appearance of the surface of the water it would hardly be perceived that the propelling power is at work at all; the water is not more agitated than by an ordinary sailing vessel, whereby the damage hitherto so much complained of, both to the banks of the river as well as to the small boats and loaded craft in their passage up and down the Pool, will be avoided entirely.

"A small boat has been built with the steering and propelling apparatus fitted, and having been found to answer so remarkably well, that it has been determined to build an iron vessel of the same size of the steam-boat called the *Bride-maid*, with two engines of ten-horse power each, with the patent apparatus attached.

"The great success which has attended the experiment in the small boat, fully warrants every hope of success in the large boat about to be built."

ON THE DOCTRINE OF PARALLEL LINES.—J. K. L.'S REPLY TO J. C.

Sir,—I am much obliged by your inserting my former letter in your No. 823; but, owing to the diagram having through some inadvertency been printed without the letters of reference, I am afraid it would be nearly unintelligible to most readers. The letters, however, may be supplied either from Mr. Scott's figure in No. 532, or from that of your learned correspondent J. C., in No. 825, which has the same letters, but differently accented. The objection which I made to Mr. Scott's method was a fatal one, and has therefore been pronounced by J. C. to be "frivolous in the extreme, and most unworthy of a geometer." It is perfectly idle to talk, as he does, of obviating that objection by diminishing the angle C′ A C; because the more that is done, the more, as I stated before, will the height above A B diminish at which L K can be proved in the supposed circumstances to differ from A B; so that for aught that can be shown to the contrary, the height of L K above A B, or the breadth of the quadrilateral A L K B, will vanish as soon at least as the angle C′ A C vanishes. Hence the whole argument founded on the diminution of that angle ends in nothing at all.

I have thus long delayed sending you any reply, waiting for J. C.'s promised defence of Sir James Ivory's solution. But most probably J. C. has by this time discovered it to be no such easy task as he had supposed, to demonstrate the tacitly assumed theorem on which that solution rests, namely, that four straight lines may always be made to meet quite around any given polygon so as completely to enclose it, let it have ever so many sides. Without proof of this, it were idle in J. C. to attempt any defence, because such an assumption is fully equivalent to Euclid's 12th axiom.

I. K. L.

INSTRUMENT FOR ASCERTAINING TEMPERATURE OF WATER AT GREAT DEPTHS.

In the extract which we published (p. 188) from Dr. Paterson's account of experiments on the temperature of Artesian Wells, an instrument is referred to as used by him in the course of his inquiry. At the request of several correspondents we take a further extract from the Doctor's interesting paper in the *Edinburgh New Philosophical Journal*, describing this instrument:—

"That objections might not be brought against this species of information, we used *an instrument which* has been long known *for ascertaining* the temperature of water at great depths. It consists of a glass-tube with brass ends which screw on; in each of these ends there is placed a valve, and both of the valves open upwards. It contains a thermometer, and is surrounded with a non-conductor; a string being attached to it, it is lowered down into the bored well. The water rushing up the bore, together with the instrument descending against it, causes both valves of the instrument to open, by which a free communication through the instrument by the valves is kept up, until it reaches the bottom of the perforation. The instrument is to be allowed to remain there for a short time, and then withdrawn as quickly as possible. As soon as we begin to withdraw this instrument, the valves close, and consequently include a quantity of water from the lowest level, at which it has been.

"We have used the above described instrument on many different occasions, and in many different Artesian Wells, both those of recent and of several years' formation, and on no occasion did we find the slightest difference of temperature between the water taken at the mouth of the bore and that brought up by the instrument."

NOTICE FROM DR. HARE, PROFESSOR OF CHEMISTRY, RESPECTING THE FUSION OF PLATINA, A NEW ÆTHER, AND A SERIES OF GASEOUS COMPOUNDS FORMED WITH THE ELEMENTS OF WATER.

[*From the American Journal of Science and Arts.*]

To Prof. Silliman.

Philadelphia, Dec. 15, 1838.

My Dear Friend.—I send you for the Journal a brief notice of some results, observations, and inferences, which are nearly in the same language in which they were communicated to the Chemical Section of the British Association for the Advancement of Science.

I have by improvements in my process for fusing platina, succeeded in reducing twenty-five ounces* of that metal to a state so liquid, that the containing cavity not being sufficiently capacious, about two ounces overflowed it, leaving a mass of twenty-three ounces. I repeat, that I see no difficulty in extending the power of my apparatus to the fusion of much larger masses.

When nitric acid or sulphuric acid with a nitrate is employed to generate æther, there must be an excess of two atoms of oxygen for each atom of the hyponitrous acid which enters into combination. This excess in-

* Troy weight. The actual quantity fused was 12,250 grains; the lump remaining weighed 10,037 grains.

volves not only the consumption of a large proportion of alcohol, but also gives rise to several acids and to some volatile and acrid liquids.

It occurred to me that for the production of pure hyponitrous æther a hyponitrite should be used. The result has fully realized my expectations.

By subjecting hyponitrite potassa or soda to alcohol and diluted sulphuric acid, I have obtained a species of æther which differs from that usually known as nitrous or nitric æther in being sweeter to the taste, more bland to the smell, and more volatile. It boils below 65° of F., and produces by its spontaneous evaporation a temperature of 0—15° F. On contact with the finger or tongue it hisses as water does with red-hot iron. After being made to boil, if allowed to stand for some time at a temperature below its boiling point, ebullition may be renewed in it apparently at a temperature lower than that at which it had ceased. Possibly this apparent ebullition arises from the partial resolution of the liquid into an aëriform æthereal fluid, which escapes, both during the distillation of the liquid æther and after it has ceased, at a temperature below freezing. This aëriform product has been found partially condensable, by pressure, into a yellow liquid, the vapour of which, when allowed to enter the mouth or nose, produced an impression like that of the liquid æther. I conjecture that it consists of nitric oxide, so united to a portion of the æther as to prevent the wonted reaction of this gas with atmospheric oxygen. Hence it does not produce red fumes on being mingled with air.

Towards the end of the ordinary process for the evolution of the sweet spirits of nitre, a volatile acrid liquid is created which affects the eyes and nose like mustard, or horse-radish.

When the new æther as it first condenses is distilled from quick-lime, this earth becomes imbued with an essential oil which it yields to hydric æther. This oil may be afterwards isolated by the spontaneous evaporation of its solvent. It has a mixed odour, partly agreeable, partly unpleasant. From the affinity of its odour, and that of common nitrous æther, I infer that it is one of the impurities which exist in that compound.

The new æther is obtained in the highest degree of purity, though in less quantity, by introducing the materials into a strong well-ground stoppered bottle, refrigerated by snow and salt. After some time the æther will form a supernatant stratum, which may be separated by decomposition. Any acid, having a stronger affinity for the alkaline *base than the hyponitrous* acid, will answer to generate this æther. Acetic acid not only extricates but appears to combine with it, forming apparently a hyponitro-acetic æther.

I observed some years ago that when olefiant gas is inflamed with an inadequate supply of oxygen, carbon is deposited, while the resulting gas occupies double the space of the mixture before explosion. Of this I conceive I have discovered the explanation. By a great number of experiments, performed with the aid of my barometer-gauge eudiometer, I have ascertained that if during the explosion of the gaseous elements of water any gaseous or volatile inflammable matter be present, instead of condensing there will be a permanent gas formed by the union of the nascent water with the inflammable matter. Thus two volumes of oxygen, with four of hydrogen, and one of olefiant gas, gave six volumes of permanent gas, which burns and smells like light carburetted hydrogen. The same quantity of the pure hydrogen and oxygen with half a volume of hydric æther gives on the average the same residue. One volume of the new hyponitrous æther under like circumstances produced five volumes of gas.

An analogous product is obtained when the same aqueous elements are inflamed in the presence of an essential oil. With oil of turpentine a gas was obtained weighing per hundred cubic inches $16\frac{5}{10}$ grs., which is nearly the gravity of light carburetted hydrogen. The gas obtained from olefiant gas, or from æther, weighed on the average, per the same bulk $13\frac{5}{10}$ grs. The olefiant gas which I used weighed per hundred cubic inches only $30\frac{5}{10}$ grs. Of course if *per se* expanded into six volumes, it could have weighed only one-sixth of that weight, or little over five grains per hundred cubic inches. There can, therefore, be no doubt that the gas obtained by the means in question, is chiefly constituted of water, or of its elements in the same proportion H^2 O.

With a volume of the new æther, six volumes of the mixture of hydrogen and oxygen give on the average about five residual volumes. The gas created in either of the modes above mentioned does not contain carbonic acid, and when generated from olefiant gas appears by analysis to yield the same quantity of carbon and hydrogen as that gas affords before expansion.

These facts point out a source of error in experiments, for analysing gaseous mixtures by ignition with oxygen or hydrogen, in which the consequent condensation is appealed to as a basis for an estimate. It appears that the resulting water may form new products with certain volatizable substances which may be present.

From the account of the proceedings of the Section, published in the Athenæum, it appears, that after my letter, in which the facts above-mentioned were stated, was read, a Mr. Maugham, who is employed to exhibit the hydro-oxygen microscope at the Adelaide Gallery, London, asserted that I had accomplished the fusion, of which mention has been above made, by means of a blowpipe of his contrivance, which I had purchased while in London.

The opinion which I am obliged to entertain of an individual capable of this groundless assertion, would cause me to consider him unworthy of notice, had not his mis-statement been made before an assemblage which I most highly esteem, and had he not been honoured by a premium for his pretended invention by a respectable British Society.

The blowpipe which is thus falsely alleged to have been used by me, differs immaterially from one of which I published an engraving and description in the *American Journal of Science* for 1820, vol. ii. p. 298, being a modification of that originally contrived by me and republished in *Tilloch's Philosophical Magazine*, vol. xiv. for 1802.

Between the instruments described in these publications, or in the *Franklin Journal*, and that employed by Maugham, the only difference worthy of notice is, that the latter is near the apex bent so as to form an acute angle, and is thus rendered suitable for directing the flame upon a revolving cylinder of lime.

Although I purchased of Newman a blowpipe bent as described, with an apparatus attached for holding and turning a cylinder of lime, *I have never made any use of it*, having for the purpose of subjecting lime to the flame, found my modification above referred to, as described in this Journal, preferable. It only required the jet-pipe to be directed upwards in an angle of about forty-five degrees with the axis of the lime cylinder.

I do not consider the form of my blowpipe employed by Mr. M. as qualified for the fusion of any metal.

It is remarkable that an apparatus of gasometers, employed by Maugham, at the Adelaide Gallery for the supply of the gases for the blowpipe, differs but little from the apparatus proposed for the same purpose in my communication above adverted to, and published nearly twenty years ago.

However, the process by which I have lately extended the power of the hydro-oxygen blowpipe may differ from those to which I had previously resorted, it differs still more from that modification which Maugham has claimed as his own.

NOTES AND NOTICES.

Packer's Pole Lathe Chuck.—Sir,—In my late communication, one thing essential to its success has been overlooked, namely—the mode of supplying it (the pole-lathe chuck,) with oil. The following is the plan that suggested itself to me:—Drill a small hole through the centre of one of the brass pins, and counter-sink both ends; introduce into the said hole, an iron pin, with a head very similar to that of a common iron screw; even a screw itself might be preferable. However, either may be used at discretion. This pin will form a valve, and one for each groove will suffice. I am, Sir, yours respectfully, R. L. PACKER.

Penny Postage.—Several highly respectable firms in London, have resolved—and announced their determination by public advertisement, not to send or receive any post letters that are not *pre-paid;* prepayment of which will be greatly facilitated by the promised issue of *stamp, stamped paper* and *envelopes*, by the use of which every person will be effectually protected against the forgetfulness or dishonesty of his servants. The policy of such a measure seems so self-evident, that it is probable it will very shortly become a universal rule, "a consummation most devoutedly to be wished." This regulation seems indeed to be part and parcel of the Penny Postage system—in fact, its very essence, *non-payment* being treated as a sort of *misdemeanour* and visited with *fines*. Government are entitled to the gratitude of every true friend of his species for this inestimable boon, which renders friendly or commercial intercourse almost "free as the air we breathe;" and they richly deserve the most cordial co-operation, in carrying out their plans, by all who are participants in this national blessing. W. B.

Beetroot Bread.—A very important discovery is spoken of in Paris among scientific men; a gentleman has succeeded in making very excellent bread from beetroot, mixed with a small portion of potato-flour. It is said that this bread is of a very excellent quality, and can be sold to the public at so low a price as two sous per pound.

Calico Printing in Naples.—An eminent engraver to calico printers in Manchester is now executing 38 engraved copper rollers (9 8ths wide) for a calico printer in Naples. Messrs. M'Farlane and Briggs are making a three-coloured machine for the same parties.—*Preston Observer.*

Exportation of Iron Steamers.—A Liverpool ship brought to Boston, U. S., a whole iron steamer, the other day, in *sections*. The length is 160 feet, I believe! They have just launched a much larger one at Pittsburg.—*Athenæum.*

At St. Louis they talk strongly of *a wire suspension bridge over the Mississippi*, and the city has appropriated money for the purpose.—*Ibid.*

Cochrane's many-chambered Rifles and Ordnance.—Mr. C. is now making a six-pounder for Mehemet Ali! He made a twelve-pounder for the Sultan, at Constantinople, in 1835, which gives eight discharges a minute, and has no recoil.—*Ibid.*

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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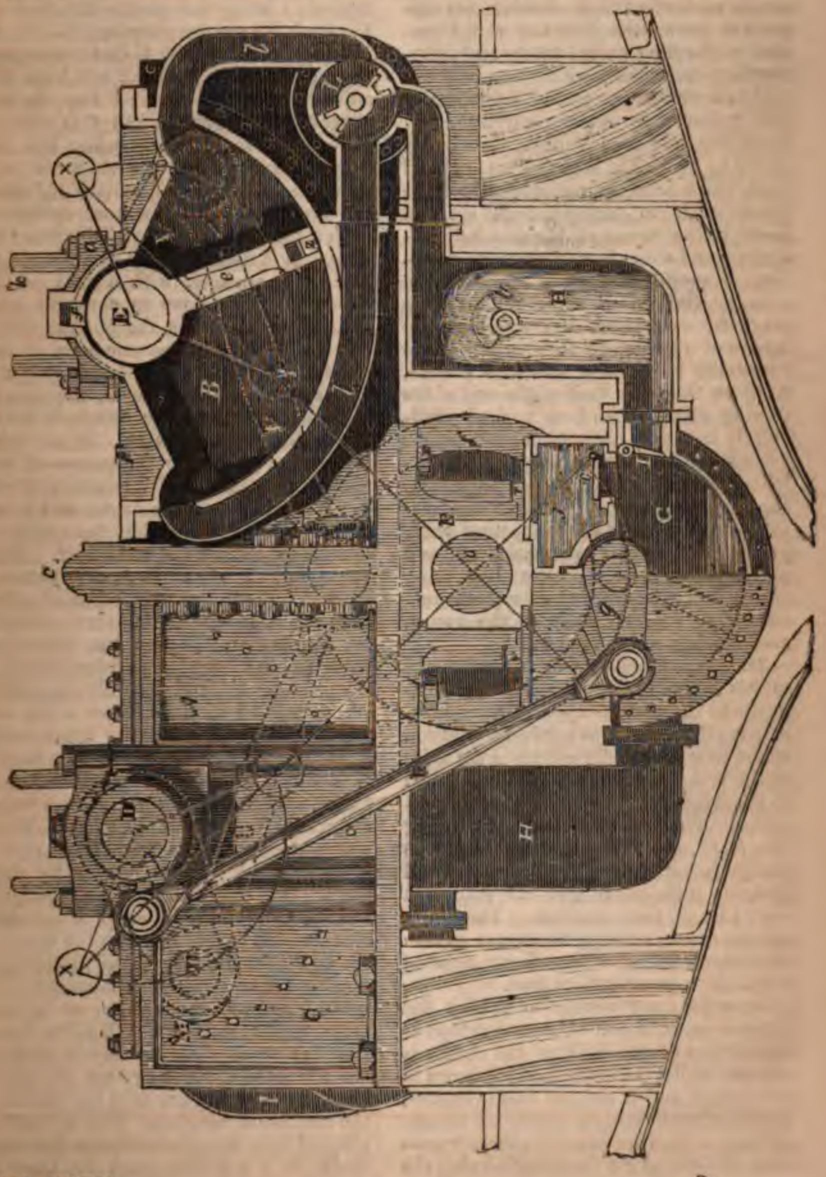


ERICSSON'S IMPROVED STEAM-ENGINE.

ERICSSON'S IMPROVED STEAM-ENGINE.

[Patent dated July 6, 1839; Specification inrolled January 5, 1840.]

This new steam-engine is intended particularly for locomotive carriages and steam navigation. It consists (as applied to locomotives) in two radial pistons performing partial rotary and reciprocating movements within two half cylindrical chambers placed horizontally and transversely on the carriage, and being attached to each other, the axes or shafts to which the said pistons are fixed (and which form their centre of motion) being made to pass through stuffing boxes in the covers of the said half cylinders, and extending in opposite directions beyond the outside frame of the carriage, the ends of these shafts being provided with crank levers, which, by means of connecting rods and pins, are connected to circular discs or cranks, fixed on the outer ends of the axis of the driving wheels. And, as applied particularly to steam navigation (that is, for giving motion to the ordinary paddle-wheels, or to any rotary stern propellers) the engine consists of similar radial piston axes, levers, and connecting rods, performing similar reciprocating and partial rotary movements, and working within half cylinders placed either transversely or longitudinally in the vessel, and attached to each other.

Three modifications or arrangements of this engine are described in the specification: the first, as applied to a locomotive; the second, as applied to a steam vessel to work paddle-wheels at the sides of the vessel; and the third, as applied to the working of any kind of stern propeller. This last arrangement, as being the most novel and beautiful, and as comprehending the others, we think will be quite sufficient to give our readers a clear idea of the invention. The figure on our front page is a transverse section of a steam vessel, with a front view of Capt. E.'s improved engine.

In order more clearly to exhibit the various parts, it will be seen that the exterior view of one half of the engine is shown, whilst the other half is shown in section; A and B are two half cylinders, provided with flanges, which are attached to cast iron frames, C C, these frames being divided at *c c*, each half serving the purpose of end cover to the cylinders, and firmly bolted together at *c c*. These frames or end covers C C are firmly bolted to timbers placed longitudinally at the bottom of the vessel; D and E are the piston shafts to which the radial vibrating pistons before mentioned are attached; *e* being the piston attached to the shaft E; *a a* are plummer blocks or bearings in the frames C C, for carrying the piston shafts, and *k k* are keys for adjusting these bearings; F F are the top covers o the cylinders, and *f* is one of the metallic rods for preventing any escape of steam round the shaft; G is a double-acting air pump, constructed upon the same principle as the steam cylinders with a similar vibrating radial piston as shown by dotted lines on the drawing; H is a condenser, with a rose jet *h*, similar to those used in common condensing engines; I is the suction valve, and *i* the valve communicating to the hot-well J; *g* is a crank lever attached to the piston shaft of the air pump, and *d* is another crank lever attached to the end of the piston shaft D. These crank levers give motion to the piston of the air pump by means of a connecting rod K; *l l* are the steam passages, and L the eduction valve, by which the steam is alternately let into the condenser. This valve, as well as the induction valve, is worked by ordinary gear communicating with the main shaft. The steam passages communicating between the induction valve and the cylinder, are placed behind the passages *l*, *l*, and similarly constructed, as will be seen in figure 5, the induction valve itself may be constructed either upon the principle of the ordinary slide valve, or like the eduction valve, L, M, and N, (shown by dotted lines) are crank levers fixed to the ends of the piston shafts. The extent of the motion of these crank levers is marked by plain lines. O is the main shaft of the engine, and the continuation thereof is a paddle shaft, which passes through the stern of the vessel for the purpose of giving motion to either a wheel constructed with spiral plates, or to a screw, or to any other rotary propeller. R R are brass bearings fitted into the lower part of the frame C C for carrying the main shaft O; *r*, *r*, are the caps for securing the said brass bearings; S is a circular plate of iron firmly attached to the main shaft; S is a double crank pin fixed in this circular plate, and which pin, by

means of connecting rods U and V, is connected to the pins *m* and *n* of the crank levers M and N. The relative position of the cylinders and the centre of the main shaft should be such that straight lines drawn through the extreme points of motion of the centres X and Y of the crank pins *m* and *n*, should intersect each other at right angles in the centre of the main shaft as shown by the plain lines.

With regard to the operation or motion of the engine—by the steam being admitted alternately on opposite sides of the pistons, and alternately let into the condenser in the usual manner, a continuous rotary motion will be given to the circular plate S, by means of the crank levers, pins, and connecting rods before described, for it is evident, that when one connecting rod is in a direct line with the centre of the crank pin *s* and the centre of the main shaft, the other connecting rod will be placed nearly at right angles to the crank pin, and the centre of the main shaft, thereby promoting the desired continuous rotary motion.

It is evident, that by changing the position of the crank levers attached to the piston shafts, the main shaft O may be placed above the centre of the half steam cylinders, as much as it is placed below the same in the engine, and it is evident, that by placing the cylinders transversely in the vessel instead of longitudinally, motion may be given to a common paddle shaft.

ON THE BEST MEANS OF BURNING GAS FOR SUPPLYING HEAT. BY SIR JOHN ROBISON, K.H., SEC. R.S.E. M.S.A.

[In a recent communication, our correspondent, Mr. Baddeley claimed for Sir John Robison, K.H., Secretary of the Royal Society of Edinburgh, the discovery and demonstration of the advantages to be derived from *the dilution of carburetted hydrogen gas with atmospheric air*, when used for culinary and other purposes. Mr. Baddeley has since forwarded for publication, the following paper, (read before the Society of Arts for Scotland, March 13, 1839, by Sir John Robison,) in further support and exposition of his former statement, and which we have *much pleasure in laying before our readers.]*

"Vix ea nostra voco."

When carburetted hydrogen gas is employed in procuring heat, it is seldom required that it should at the same time give out light; the combustion may therefore be managed in any way which may be convenient, without seeking to preserve the illuminating power.

It appears to have occurred about the same period to the late Dr. Duncan and to myself, that, by passing a current of gas mixed with atmospheric air through a wide vertical tube having its upper end covered by a diaphragm of wire gause, and by kindling the mixture as it escaped through the interstices of the wire cloth, a convenient stove might be formed for culinary purposes. Dr. Duncan applied some small apparatus on this principle to pharmaceutical operations in his class room; and I had my kitchen furnished with a range of large stoves which were intended to supersede the use of French charcoal stoves in various culinary processes. In both cases the success has been perfect, and the same principle has since been adopted with advantage in a variety of processes in the useful arts, where this neat and cleanly method of applying heat has rendered it a valuable acquisition to the workshop. The form of the apparatus may be varied in any way to suit the particular process to which it is to be supplied; as all that is essential, is that a current of the mixed gas and air shall rise through wire cloth, and that the proportion of gas to atmospheric air shall never be so great as to allow of the flame becoming yellow, as with this precaution, the combustion of the carburetted hydrogen will be complete, and no deposit of soot will take place on cold bodies when set over the flames. The proper quantity of gas in the mixture is easily determined by the stop cock belonging to each stove.

For ordinary culinary purposes, the cylinders may be 30 inches long, and 3 to 4 inches diameter, and the wire cloth for the tops should have about thirty wires to the inch. That which is manufactured for safety lamps answers well for this purpose.

Whenever, from accidental injury, or decay, a hole takes place in a diaphragm, it is no longer possible to use it, as when lighted, the flame passes through the fracture and communicates with the jet

at the bottom of the cylinder, which then burns like an ordinary gas light, and like it, would blacken the surface of any cold body presented to it. The wire cloths, if not broken through by violence, will last for months, although in daily use, and if covered by a layer of coarse sand, or pounded limestone will continue serviceable for an unlimited period.

When more intense heat is required than is attainable by the unaided combustion of the mixed gases, recourse may be had to various forms of blow pipes; and when a large volume of such flame is to be employed, the current of atmospheric air may be urged by double bellows. A very efficient apparatus on this principle is to be seen in the laboratory of Dr. D. B. Reid.

It is to be regretted that such applications of gas are not more generally known and introduced into workshops, as there are numerous processes in the arts in which they would afford facilities to the workman which he can scarcely command by any other means; for example, in the hardening of steel tools, it is well known that a piece of bright steel when heated to redness in a forge, or muffle, is subject to oxidation, and that a black scale remains after hardening, which it is difficult to remove without some injury to the work, as in the case of a screw tap; whereas, if the same piece of steel be heated in a flame of the mixed gases, where there is no free oxygen to attack its surface, it may be *made and kept* red-hot without any injury to its finest edge; it will be discoloured, but without losing much of its polish. The artist has also the advantage of a distinct view of the article while it is being heated, and the power of withdrawing it from the flame the moment it has acquired the proper colour, which in the hardening of cast-steel cutting tools is of great importance.

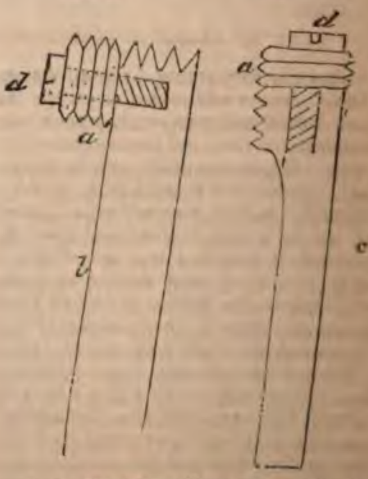
Many attempts have been made to apply carburetted hydrogen and pure hydrogen gases to the purpose of warming buildings, and a variety of forms of stoves have been proposed, on the understanding, it would appear, that, by applying the flame of the gas to metallic bodies, an increased degree of heat would be communicated by them to the *atmosphere around them*; a little *consideration will show*, that however the *distribution* of the heat may be modified by such contrivances, there can be no increase of the heating power; and that when a certain measure of gas is fairly burned, the heat evolved into the apartment will be the same whether the flame be disposed as a light, or made to play against metallic plates, or other combinations of apparatus. In all cases where the products of the combustion are allowed to mix with the atmosphere of the apartment, without provision being made for carrying them off by ventilation the effects of such processes must be more or less deleterious to health according to the proportion these products bear to the mass of air they mix in.

On the whole, it may be assumed that this mode of heating apartments is the most expensive, the least efficient, and, excepting that by Joyce's charcoal stove, the most insalubrious that can be resorted to.

NEW CHASING TOOL.

Sir,—Those, who, like myself, are inexperienced in the use of chasing tools, have often to complain of the difficulty of beginning the thread upon the lathe; to obviate this difficulty I have contrived a tool which works very well, but only where a long screw is required, as the roller comes, in a short length, immediately on the shoulder.

Fig. 1. Fig. 2.



a, a, are two rollers cut with the same pitch of thread, which is borne by

the two chasing tools *b* and *c*.* They turn easily on two screws *d*, *d*, which, being double shouldered, are firmly screwed into the tools; fig. 1 is the outside chasing tool, fig. 2, the inside one. When used upon brass or soft iron, I find very small teeth cut perpendicular to the plane of the threads on the roller, preferable to what I would recommend for wood, namely, the roller threads brought up to sharp knife edge.

Your giving this unimportant idea a place in your valuable journal, will much oblige yours, &c.

ALEX. BRYSON.

8, South Bridge, Edinburgh, Dec. 18, 1839.

MR. GRAY, PROJECTOR OF THE RAILWAY SYSTEM.

"*La Verite s'y accorde, elle ne manque jamais.*"

Sir,—My duty compels me to address you, and justice will, no doubt, prompt you to give this early insertion.

In your No. 842, for September last, your correspondent brings forward Mr. W. James as the railway projector for England; now, Sir, as dates are rather perplexing to persons who are endeavouring to trick others out of their right, I would advise your correspondent to be cautious how he proceeds, for he will already find communications made public by me, *many years before those of his friend.*

I am, Sir, your first correspondent on the subject, as your Magazine will always prove, and long before it was published my innumerable communications and advertisements on the railway system may be seen and referred to by any person who prefers truth to falsehood, and therefore, Sir, I shall not allow any individual to deprive me of my just claim on the public as the original projector of a general system of railways throughout Great Britain and Ireland.

Pray, Sir, are you astonished to see most of the railways at a discount? and so they must ever remain, unless the respective directors thereof alter them very materially both in the construction and management.

The public favourites, who have squandered away the public resources, will very soon be found out; what I so long ago predicted *is now coming to pass*, and all the poor deluded subscribers will bewail, too late, their mistaken confidence in those individuals who hitherto have been employed in making railways, which makes good the old adage "*praise undeserved is censure in disguise.*"

I am, Sir,

Very respectfully yours,

THOMAS GRAY.

Exeter, Jan. 16, 1840.

CASE OF BACON *v.* SPOTTISWOODE—CONDUCT OF MR. HUTCHISON.

Sir,—In forwarding to you the enclosed, let me add that this is the last time I shall notice any anonymous communications from the London Gas Company. Representations, wilfully false in fact, having been published, under a feigned signature, by the parties opposed to me in a hostile suit—and then disavowed—I feel that but one course is open to me; I must decline to notice any reply to this statement (which I have guaranteed by my name,) *unless such reply be guaranteed in the same manner by the Chairman and the other respectable members of the Company* to which I have alluded. But let me add, that, though I will not be a party to covert attempts to bias the public mind and the proceedings of our Courts *of Justice, I shall not shrink from fair discussion.* On the contrary, *should my opponents* adopt the same course as I have done, I shall be most desirous to concur with them in giving the greatest possible publicity to our respective statements, in order that they may mutually correct each other where wrong, and mutually support each other where incapable of refutation.

I have the honour to remain,

Your obedient servant,

HUGH FORD BACON.

Fen Drayton, Cambridgeshire.

[We regret exceedingly that the unfair use which Mr. Hutchison, or Mr. Hutchison's friends, have made of a too free access to the pages of the *Mechanics' Magazine*, to depreciate the valuable invention of Messrs. Bacon and Kilby, and to exaggerate the merits of Mr. Hutchison's own alleged inventions, should have made it necessary for our reverend and respected correspondent to reply

upon his assailants in terms of such severity as he has done in the following paper. Much allowance must, however, be made for the honest indignation which it is natural to every person to feel, when attempted to be made the victim of wilful misrepresentation and dirty underhand dealing. We have ourselves seen the original specification of Messrs. Bacon and Kilby, and find that it *does contain* certain important matters which Mr. Hutchison's champion, "Clovis," though "writing with that specification before him, suppressed," making that suppression a handle of to the prejudice of these gentlemen. "Clovis" has been therein guilty not only of a grievous injustice to Messrs. Bacon and Kilby, but of an imposition on ourselves, which, considering the editorial kindness he had previously experienced at our hands, was altogether inexcusable. On both accounts, therefore, we surrender him and his abettors, with hearty good will, to the rough but well-deserved castigation which follows; and sincerely hope, that the insertion of the present communication will go far to make amends to Messrs. Bacon and Kilby, for the injury of which we have been, unconsciously on our parts, made the medium. We need scarcely add, that, *after what has passed*, ("Clovis" will understand what we mean); any reply to this paper must be signed by the real name of the author.—Ed. M. M.]

The Piracies of Mr. Hutchison and the conduct of the London Gas Company.

In your Magazine has appeared—in a series of letters, signed "Clovis"—the most wilful misrepresentations of the facts of the suit of "Bacon against Spottiswoode" (instituted by me against the Chairman and other members of the London Gas Company. In a letter, signed "Justus," *I deprecated discussions on disputed claims*. But my protest was of little avail; it only called forth an answer in which my invention—the subject of the suit—*was fraudulently misdescribed!* In reply, I pointed out the deception, and referred for proof to my *specification*. But the only satisfaction I obtained, was an answer in which the first mis-statement was supported by a *fraudulent misrepresentation of the specification itself!* And *these letters* were followed up by a false report of the decision of the Master of the Rolls, by whom the cause was tried. This *report was so palpably untrue*, that it was *rejected* by the Editor of the *Mechanics' Magazine*, and the account given in the *Times* substituted!*

Mere *fallacies of reasoning* may be refuted, but *false statements thus hardily reiterated* must be met in a different manner, viz., by *pointing out their origin*, and exposing the interested and discreditable motives to which they are attributable. Your readers will be surprised to learn that these productions, though *disclaimed on their behalf by their Engineer, Mr. Hutchison*, have been eventually traced to the *last source* from which they could with propriety have emanated, viz., *the defendants in the cause—the London Gas Company!* And in the inquiry which, in self-defence, I was thus compelled to set on foot, I have ascertained that this proceeding—however mean and unmanly in itself—only forms a part, a mere subordinate part, of a system of artifice and imposture—of a project which, under fair pretences, is nothing better than a monstrous scheme of invasion against the plainest rights, public and individual.

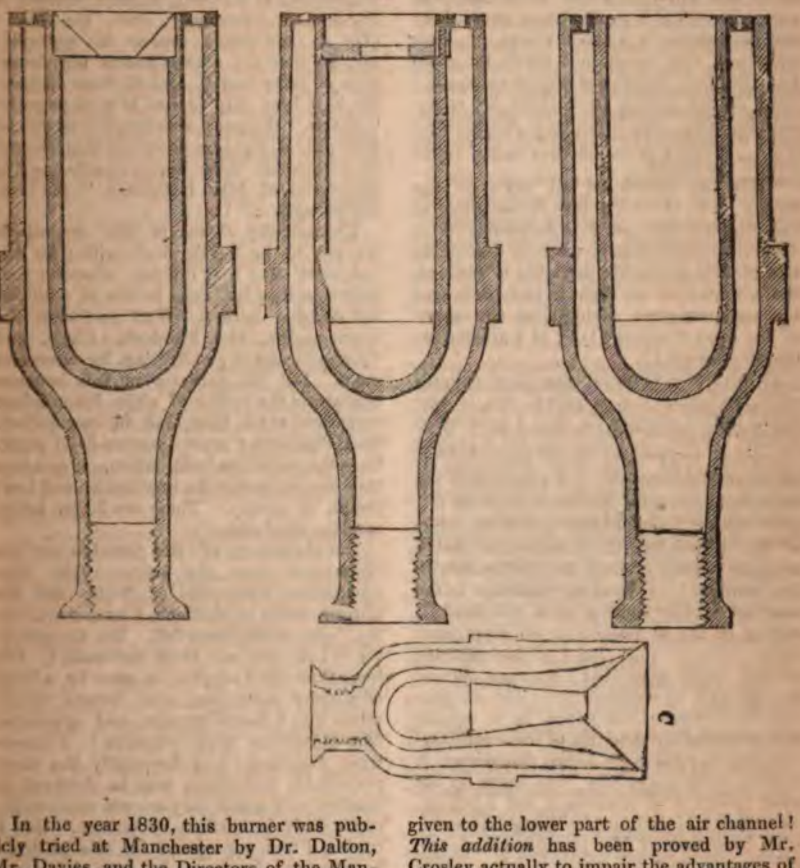
The chief object of these very disinterested productions, is to make out that my claims are groundless, and that Mr. Hutchison is not (as I contend) a common piratical invader of those claims, but a great and original inventor! I shall not shrink from the inquiry which has thus been forced upon me, (with what discretion will presently appear).

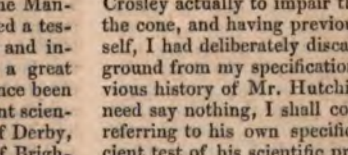
Happily, though the subject is a scientific one, its details are so simple, that, by the aid of the subjoined diagrams, I shall be enabled to make them easily intelligible to the general reader. In the year 1829, a patent was granted to Mr. Kilby, a brother clergyman, and myself, for an improvement on the Argand Gas-burner, which it is well known forms a circle or cylinder of flame, fed with air both on the outside and also on the inside (see diagram A.) The gas flows from a circle of jets which surround the central air passage, and unite into one hollow mass of flame protected by a glass chimney. Mr. Brande found that this burner gives double the light with the same consumption as a number of separate jets. He ascribes this effect not only to the improved distribution of the air, but also to *its limitation* by means of the glass, and to the heat caused by the union of the jets. Sir Humphrey Davy had previously proved that the admission of *more air than is indispensable* to combustion, only cools the flame of gases and reduces their light. An attentive examination of the principles of his work "on the Safety-lamp and on Flame," led to the conclusion that *even in the Argand there is an excess of air*, and an inverted cone was de-

* Mec. Mag. April 9, May 27, July 1, August 19, Sept. 9, 1837, and May 18, 1839.

vised to contract the central air passage which was combined with an external upright cone (previously in use) to restrict the outer current. The result was a further saving of gas on the Argand. We also patented a flat metallic ring, D, that might be used instead of the inner cone, though of *inferior utility*.

A B D





C

In the year 1830, this burner was publicly tried at Manchester by Dr. Dalton, Mr. Davies, and the Directors of the Manchester Gas Company, who published a testimonial as to the superior quality and intensity of its light, combined with a great saving of gas; results which have since been repeatedly confirmed by many eminent scientific men—Mr. Crosley, Dr. Fox, of Derby, Professor Buckland, Mr. Rutter, of Brighton, &c. In the year 1835, I was compelled to proceed in Chancery against the London Gas Company, who I learned were selling a burner of the form marked C, which had been patented, in 1833, by their Engineer, Mr. Hutchison. This burner, you will observe, is of *precisely the same shape as mine in the upper part, viz., conical*, and it differs from it *only* in the curved shape, E, given to the lower part of the air channel! *This addition* has been proved by Mr. Crosley actually to impair the advantages of the cone, and having previously tried it myself, I had deliberately discarded it on that ground from my specification! Of the previous history of Mr. Hutchison at present I need say nothing, I shall content myself by referring to his own specification as a sufficient test of his scientific pretensions. His improvement is therein said to consist in the introduction "of a funnel into the centre of the burner, instead of the cylinder of uniform diameter in general use." Now, what is meant by this vague word "funnel?" You will be surprised to learn, that it includes not only my cone which he has pirated, but also the conical curves below, which he has added as a screen for his piracy. But why

is the plain and appropriate word "cone" avoided, while the mystical word "funnel" is used instead? Because the very use of the word "cone" would have betrayed the source from which he had borrowed—would have been *a plain admission of piracy*. The same discreditable course (and from the same discreditable motive) was pursued by the defendants in Chancery and by their witnesses, who would not admit the plain fact, that their burner was conically shaped(!) until it was wrung from them by cross-examination! The following is Mr. Hutchison's "philosophical" exposition of the action of the funnel.

"The air *drives* on all sides on the flame!" * * "By the *funnel form* of the orifice a *stronger* (!!) *current of air* is driven upon the flame, whereby *destroying in a greater degree* the *impurity of the gas*, the brilliancy of the light is increased, and the inconveniences arising from the *escape of the impure vapour* (!) is to a greater extent *diminished*!!"

It will excite the astonishment of enlightened foreigners that a patent can be obtained in this country for such a production as this! From me it requires but a passing comment. The ideas about *destroying* (!) *the impurity* of the gas, and diminishing the inconveniences from the escape of "the impure vapour," betray the grossest ignorance of first principles; the assumption that a *stronger* current of air is the *desideratum* in gas-burners, is in direct contradiction to the doctrine of the benefits of a *restricted* (!) supply of air as proved by Sir Humphrey Davy, Mr. Brande, &c.! Moreover, the strange assumption that a stronger current is produced by contracting (!) the air passage by means of the cones, is in equally direct contradiction to one of the *most familiar* laws of physics!* Great discoveries, it is true, have sometimes been made by the most ignorant of mankind; but I believe, nevertheless, I shall not be thought to speak with harshness of Mr. Hutchison's claims, if I observe, that he seems to have appropriated my invention even before he was competent to understand its principle.

But Mr. Hutchison's patent was not confined to mine. 1. In the very same specification he actually patented *eight separate and independent inventions* connected with the art of gas-lighting, which were all either taken from other men's patents, or notoriously in use before.

2. Nor are his pretensions confined to the inventions included in his patent. Through the impartial pen of "Clovis," he has claimed, as his patent inventions, several improvements, of which he is *neither the patentee nor the inventor!*

3. He has claimed *without a patent, or the pretence of a patent*, a great number of discoveries notoriously not his own! (He is sometimes *content* to *appropriate*, he does not *always patent* the *inventions* of *other men!*) And all these discoveries have been duly praised in your pages by "*Clovis*," the same *disinterested writer* of whom Mr. Hutchison knows nothing, though he claims all these improvements as the discoveries of Mr. Hutchison "*the celebrated engineer*"!!

Undoubtedly claims of this magnitude are not to be lightly dealt with; for the judgment that they call for, whatever that judgment may be, must be one of a serious and decisive nature. Watt perfected the steam-engine, and Murdoch, Clegg, and Crosley the art of gas-lighting, by successive steps. But the patentee in this instance appears as the author of eight independent inventions at one time, and in one patent. Such discoveries must command—if genuine—the respect and admiration,—if spurious they cannot escape the reprobation and contempt, of society. There can be no intermediate conclusion.

But the history of this patent is not less remarkable than the patent itself. The momentous discoveries of Watt, and the improvements of Murdoch, Clegg, and Crosley, were tardily rewarded. But the patentee in this case was more fortunate! His inventions were adopted at once by a body of wealthy capitalists, who formed themselves into a Gas Company, and appointed Mr. Hutchison their engineer! I know from experience how frequently the most respectable individuals may be deceived in matters with which they are not conversant, particularly in matters of science. But I confess I was unprepared for this project! I presume, however, it may in some measure be accounted for. Had Mr. Hutchison speculated in a piratical patent including *every form of railroad from the first line at Darlington to the last experiments* on the *Great Western*, he must have known that his enterprise would long ago have held its proper place in public estimation! But the processes of the gas engineer *are less exposed to the public eye!* Hence a veil may for a time be thrown over the most flagrant piracy of the whole art, from the retort, in which the gas is generated, to the burner in which it is consumed! Of the character of these "*inventions*," and of the means used to force both

* This law is, that the contraction of an air passage *diminishes the supply*; and that even to preserve *the same supply*, the moving power must be *increased as the square of the contraction*.

them and their supposed inventor into public notice, I shall now give a few specimens. One of the "*discoveries*" patented by Mr. Hutchison is a patent double-lifting gasometer. In the *Mechanics' Magazine* for January, 1836. p. 322, there appeared an article from the impartial pen of "Clovis," which commenced as follows :—

"Sir—The many valuable inventions, a knowledge of which have been communicated to the world through the columns of your excellent work, has induced me to send you the following description of Mr. Stephen Hutchison's double-lifting gasometer. Of all the various *improvements that have been made* in the *construction of machinery* in the present day, *I believe there are none* (upon the score of economy) *of equal importance* with that ingenious contrivance, of which I send you an account!"

After a great deal to the same effect, and a description of this gasometer (into which it is not necessary to enter), we are told that "notwithstanding the formidable host of engineers, whose opposition was strenuously exerted against him, the expectations of the inventor had been most successfully realised, and the *correctness of* his judgment as a civil engineer satisfactorily established." The letter concludes with the following startling assertion :—

"The many *improvements*, independent of his gasometer, which this engineer has introduced, for the purpose of economising and facilitating the process of manufacturing gas, has had *an extraordinary effect in reducing its price*. To *his ingenuity*, and to the *confidence which the proprietors of the London Gas Company* had in his abilities, the public of this metropolis owe that reduction (*a reduction of* 40 *per cent.* ! !) which *has now taken place* in the price of an article which has become almost an indisdispensable necessary of life."

With all who are conversant with the history of gas lighting in the metropolis the singular assertion that the price of gas has been reduced 40 per cent. by the agency of Mr. Hutchison, will possess all the weight to which it is entitled! But, whatever may be thought of the conduct or motives of those by whom such statements are promulgated, it cannot influence the claim to inquiry which has been thus challenged on behalf of Mr. Hutchison. To that inquiry he has a right in this instance on far higher, on more serious grounds than any of a mere pecuniary nature. Not only is the value and ingenuity of this contrivance indisputable, (it is the most striking invention claimed in this patent) but what is still more important, Mr. Hutchison—in fulfilment of a preliminary required of all patentees—*has attested by his oath* his belief *that he is the first inventor* of all *that his specification contains*. To claims advanced under the most sacred of all sanctions a calm and attentive consideration cannot be denied, because, not only are the interests of the claimant involved, but he has a more momentous stake in the issue. With these impressions I have quoted what has been said in the matter on behalf of Mr. Hutchison. It only remains for me to advert to the discussion which those statements called forth. In your number for February 6th, 1836, appeared a letter signed "*W. Tait*," which commenced as follows :—

"Sir,—In your last Saturday's number there is a description of what is termed a 'double-lifting gasometer,' said to be the invention of Mr. Stephen Hutchison. *If there be any merit in the invention, I believe Mr. Hutchison must allow me to lay claim to a priority of right to it!!*

"In the *London Journal of Arts and Sciences* for June, 1824, p. 305, *will be found a rough* representation in outline on a small scale, and a description of a gasometer *exactly similar in all its essentials*, to that *claimed by Mr. Hutchison* as his invention!!" (Then follow extracts to that effect.)

In answer to this letter, "Clovis" took great pains to *disparage* Mr. Tait's invention, at the same time that he reiterated his advocacy of Mr. Hutchison's pretensions. Mr. Tait brought the correspondence to a close by observing that it was a notorious fact that Mr. Hutchison had actually brought an action for "an infringement" of this gasometer, against a well-known establishment, the City Gas Company, *which action he had lately very precipitately abandoned!!* Could "Clovis," he asked, be ignorant of all these circumstances? In his reply, the writer had the effrontery to affect the most profound ignorance of these incidents, though writing from the source where these facts were most notorious.

I have adverted to this correspondence because it is a *characteristic* example of the conduct of these persons. First, the discoveries of other men are shamelessly appropriated and litigiously maintained against the public at large. But when the real inventor steps forward and the fraud is detected then no artifice is spared, no misrepresentation is left untried to depreciate the very invention which they had eulogised in the most fulsome manner so long as they hoped to make it a subject at once of piracy and of monopoly.* I shall now give another instance :—

In your number for June, 1839, page 161,

* Mech. Mag. Jan. 30, 1836, Feb. 6, Feb. 20, Feb. 27, March 5, and March 19.

was published an encomiastic letter signed "C." (Clovis) containing a description of Mr. Hutchison's "Dry Lime Gas Purifying Apparatus," another "discovery" claimed by him in his patent. In your number for August 3, this letter produced the following comments:—

"Sir,—In the *Mechanics' Magazine* for June 8, No. 826, there is a drawing and a description of 'a novel mode of purifying gas,' by Mr. Hutchison of the London Gas Establishment. Now, Sir, I have been working a set of four purifyers with a circular tank *in every respect the same* as those described by this gentleman, for the last nine years past!! and, as I did not presume to think that there was any novelty in the arrangement *at that time*, I must say I should have been very much amused with the ingenious modesty that could trumpet forth its unknown merits in 1839, did I not think, Mr. Editor, that the valuable pages of the *Mechanics' Magazine* are deserving of a more beneficial appropriation. Indeed, we must see something claiming, with more justice, the attention and imitation of gas engineers than the puffs which have hitherto accompanied Mr. Hutchison's name, before he can be entitled to the credit of novelty in the description he has hitherto favoured us with, whether of apparatus for purifying gas, or economy in the working of the retorts. * *

"R. Young, Nottingham."

To this there has been no reply.

I have already adverted to one of Mr. Hutchison's peculiar practices. He does not scruple to claim as *patent inventions*, contrivances for which he *never obtained a patent!* Thus, in your number for April 9, 1836, there is a description by "Clovis" of his "patent gas generator for the use of shipping." Into the merits of this invention, or his claim to be considered the inventor, I will not now enter. I need only remark at present, that it is a gross and wilful imposition on the public, to state that the instrument was included in his patent!

But I feel that it is needless to pursue this subject further. Deceit and pretension and imposture are topics on which few choose to dwell, I shall, therefore, return to those matters in which I was directly interested. As I have previously intimated, after my bill in Chancery was filed, a series of letters appeared from "Clovis," which strikingly illustrate the system and the dispositions of the parties he represents. Not only are these letters false in fact, but what is still more observable (*though traceable to the same source)* they directly contradict in *many vital points the answer of the defendants whose cause they advocate*! For example, in the answer, the sale of Hutchison's Burner is said to be small in value and amount, and confined to the customers of the Company; and the *use of the cone* (which forms my invention) is *denied.* In these letters, on the other hand, Hutchison's Burner is stated to have been very generally substituted "*for the old burners throughout the metropolis* (!!)," and to have been introduced. together with Mr. Hutchison's "other great improvements, into *the United States*, particularly at New York"! and the *cone*, so far from being *repudiated,* is boldly claimed as Hutchison's invention!! But not only is the cone claimed, but the absurd theory of a stronger current, contained in his specification, is thus disclaimed.

"I am aware," says Clovis, "that it is the opinion of many gas engineers and chemists, that in order to insure a perfect combustion, the air which ascends should be mechanically urged towards the flame with the greatest possible velocity!! But this is an *erroneous conception*, as I am persuaded that no experiments ever instituted, could ever *warrant* so *unphilosophical* a conclusion,"

So that my opponents have not disdained to make, before the public, fabricated claims which they know to be too ridiculous to be safely made in Court! Where defence is their object their sales are limited, and their pretensions humble; where puffery is their object, their claims are even more comprehensive than the patent of Mr. Stephen Hutchison! But the frauds by which that gentleman's claim to the use of the cone was supported, are even more extraordinary than the claim itself! Your readers will recollect that my patent included not only the cone, but a flat metal ring, which being of inferior utility, was never used in the manufacture. Yet in reply to a letter written by myself, signed "Justus," in which I referred to my prior claim, "Clovis" published a fabricated diagram of a burner, containing one of these metal rings, and which he said he had bought from the London agent for the patent burner! And he asserted that this was the whole of Kilby and Bacon's invention; In answer I denounced this gross fabrication, and I referred to my specification as a proof that the cone was its leading object. The reply surpassed in effrontery all that preceded it, it stated that "Clovis" was writing with my specification before him! and it does not contain a cone at all!*

To any man of proper feeling (whatever

* Mec. Mag., April 9, May 27, July 1, Aug. 19, Sept. 1, 1837; May 18, 1839.

confidence he may entertain in his own just rights) it is an unmixed evil to be harrassed by constant collision with persons by whom all principle, and all truth, are habitually disregarded! The last of these letters goes beyond all the rest of the correspondence. Not content with putting forward fabricated patents to serve his purpose, this writer (Clovis) closed his labours, as before stated, with a fabricated report of the decision of the Master of the Rolls. Such an outrage on the proceedings of a Court of Justice may demand the severest legal retribution; for though the report was rejected from your *Magazine*, a variety of statements were admitted which wholly misrepresent what took place. From these statements it might be inferred that my patent was declared void, as "a notoriously objectionable and destructive burner," while Mr. Hutchison's absurd pretensions were perpetuated by the Court! It is true that these defendants obtained a decree, but it was by the same means that they obtained a patent, and by the same means that they have supported it! The Master of the Rolls (and the Lord Chancellor afterwards) decided the case on the ground that, by having brought it to a hearing, without moving for an injunction, or for leave to bring an action, I had subjected the defendants to the evils of suspense and delay. Now what will you think of their conduct when you are informed that I formally offered, at an early stage of the cause, that all questions should be tried in an action, and that this offer was by them peremptorily declined. The delays on which they relied were therefore of their own choice, of their own creation! My solicitor had prepared an affidavit of this offer, but he was advised by his Counsel that it was not receivable by the rules of the Court.

Throughout the proceedings the defendants themselves used every means to create delay and expense, and to avoid a fair trial of the question between us. 1. They withheld the names of their partners, which I was driven to extort by my bill. 2. By their litigious conduct they made two suits necessary: one against the company, and another against their manufacturers; and they declined my offer to abide by the result of one of them, and yet they complained, at the hearing, of the injustice of two suits for one matter!! 3. Believing I had to deal with a highly respectable body of persons, I consented to take their answer without oath or signature. In return, they put in a most evasive answer, which, if on oath, would have been scarcely safe. They did not admit their use *of the cone, though it is plain on inspection, nor did their witnesses till cross examined!* 4. Both the defendants and their witnesses deposed to the existence of a "stronger current" in Hutchison's burner as known to them "by *experiment*," though it is a physical impossibility which never can have been thus proved! Moreover, the unscrupulous spirit of a concerted tale is shown by their contradictions. They all use the catch word "velocity," but it turns out that none of them use it in the same sense! Comparing Hutchison's burner with the Argand, two of the witnesses say that the supply of air in the former is *greater*; the defendants themselves that it is *less*; and another witness that it is *the same*! 5. They tried to evade an efficient account of their profits, the manufacturers professing to sell at a low price to the company, who professed to sell again at mere cost price.* (Information obtained by means of a circular is inconsistent with this statement.)

Such, Sir, is the narrative that has been required at my hands, and such is the scheme which has long existed unobserved in the very heart of this metropolis. I take my leave of these repulsive details, and, in doing so, I might freely express the feelings which they inspire; but I shall abstain from doing so, because I am sensible that all comment must be needless on practices on which the sentiments of society will be intense and unanimous. Some remarks, however, arising out of the case, I shall probably trouble you with in a future communication. Meanwhile,

I remain, Sir,
Your obedient servant,
HUGH FORD BACON.

EXPERIMENTS TO ASCERTAIN THE DEPTH OF THE SEA.

[*From the Proceedings of the American Philosophical Society.—Franklin Journal.*]

Dr. Patterson read a paper by Professor Charles Bonnycastle, of the University of Virginia, containing "Notes of Experiments made August 22nd to 25th, 1838, with the view of determining the depth of the sea by the echo."

This paper, which was not offered for publication in the Society's Transactions, states, that the generally received notions in regard to the intensity of sound in water, and the distance to which it is conveyed, had suggested to Mr. Bonnycastle, some years ago, the idea that an audible echo might be returned from the bottom of the sea, and the depth be thus ascertained from the known velocity of sound in water. The probability

* This entitles me, I presume, to a strict account of the savings of gas made by the company on contract lights—and by their customers on meter lights; otherwise a patent may be pirated with impunity.

of this view was deemed at least sufficient to justify an experiment; and accordingly the navy commissioners authorized the construction of the necessary apparatus, and Captain Gedney, of the U. S. brig Washington, attached to the coast survey, volunteered his services and the use of his vessel, and authority to this effect was liberally granted by the Secretary of the Treasury, Mr. Woodbury.

The apparatus, which is fully described in Mr. Bonnycastle's paper, consisted, first, of a petard or chamber of cast iron, 2½ inches in diameter, and 5¼ inches long, with suitable arrangements for firing gunpowder in it under water; secondly, of a tin tube, 8 feet long and 1¼ inch in diameter, terminated at one end by a conical trumpet-mouth, of which the diameter of the base was 20 inches, and the height of the axis 10 inches; thirdly, of a very sensible instrument for measuring small intervals of time, made by J. Montandon of Washington, and which was capable of indicating the sixtieth part of a second. Besides these, an apparatus for hearing was roughly made on board the vessel, in imitation of that used by Colladon in the lake of Geneva, and consisted of a stove-pipe, 4½ inches in diameter, closed at one end, and capable of being plunged four feet in the water. The ship's bell was also unhung, and an arrangement made for ringing it under water.

On the 22nd of August the brig left New York, and in the evening the experiments were commenced. In these, Mr. Bonnycastle was assisted by the commander and officers of the vessel, and by Dr. Robert M. Patterson, who had been invited to make one of the party.

In the first experiments the bell was plunged about a fathom under water and kept ringing, while the operation of the two hearing instruments was tested at the distance of about a quarter of a mile. Both instruments performed less perfectly than was expected; the noise of the waves greatly interfering, in both, with the powers of hearing. In the trumpet-shaped apparatus, the ringing of the metal, from the blow of the waves, was partly guarded against by a wooden casing; but, as it was open at both ends, the oscillation of the water in the tube was found to be a still greater inconvenience, so that the sound of the bell was better heard with the cylindrical tube. At the distance of a quarter of a mile this sound was a sharp tap, about the loudness of that occasioned by striking the back of a penknife against an iron wire: at the distance of a mile the sound was no longer audible.

In the second experiments the mouth of *the cone, in the trumpet* apparatus, was *closed with a plate of* thick tin, and both instruments were protected by a parcelling of old canvas and rope-yarn, at the part in contact with the surface of the water. In these experiments the cone was placed at right angles to the stem, and the mouth directed toward the sound. The distances were measured by the interval elapsed between the observed flash and report of a pistol. At the distance of 1400 feet, the conical instrument was found considerably superior to the cylindrical, and at greater distances the superiority became so decided, that the latter was abandoned in all subsequent experiments. At the distance of 5270 feet, the bell was heard with such distinctness as left no doubt that it could have been heard half a mile further.

The sounds are stated in the paper to have been less intense than those in air, and seemed to be conveyed to less distances. The character of the sound was also wholly changed, and, from other experiments, it appeared that the blow of a watchmaker's hammer against a small bar of iron gave the same sharp tick as a heavy blow against the large ship's bell. It is well known that Franklin heard the sound of two stones struck together under water at half a mile distance; yet two of the boat's crew, who plunged their heads below the water, when at a somewhat less distance from the bell, were unable to hear its sound.

On the 24th of August, the vessel having proceeded to the gulf stream, experiments were made with the view for which the voyage was undertaken; that is, to ascertain whether an echo would be returned, through water, from the bottom of the sea. Some difficulties were at first presented in exploding the gun under water, but these were at length overcome. The hearing-tube was ballasted so as to sink vertically in the water. The observers then went, with this instrument, to a distance of about 150 yards from the vessel, and the petard was lowered over the stern, about three fathoms under water, and fired. The sound of the explosion, as heard by Mr. Bonnycastle, was two sharp distinct taps, at an interval of about one-third of a second. Two sounds, with the same interval, were also clearly heard on board the brig; but the character of the sounds was different, and each was accompanied by a slight shock. Supposing the second sound to be the echo of the first from the bottom of the sea, the depth should have been about 160 fathoms.

To ascertain the real depth, the sounding was made by the ordinary method, but with a lead of 75 pounds weight, and bottom was distinctly felt at 550 fathoms, or five furlongs. The second sound could not, therefore, have been the echo of the first; and this was proved, on the following day, by re-

peating the experiment in four fathoms water, when the double sound was heard as before, and with the same interval.

The conclusion from these experiments is, either that an echo cannot be heard from the bottom of the sea, or that some more effectual means of producing it must be employed.

Dr. Hare suggested the expediency of employing the galvanic fluid to fire gunpowder below the surface of water, in experiments similar to those of Professor Bonnycastle.

MINING SCHOOL—QUESTIONS IN MECHANICS PROPOSED TO STUDENTS.

The Professor of Mechanics proposed the following questions to his class :—

Mechanics.—1. What conditions are necessary to the equilibrium of any number of pressures in the same plane? By what experiment may the existence of these conditions be proved?

2. What is meant by the *resultant* of any number of pressures; and what by the *composition* and *resolution* of presssures?

3. Define accurately the centre of gravity.

4. Show how the amount of the force acting in a given direction, which is necessary to draw a heavy body up an inclined plane, subject to friction, may be determined; and how the direction of the *least* force which will draw the body up the plane may be found.

5. A rectangular mass of cast iron, whose base is two feet square, rests upon an inclined plane of oak inclining 35°. It is on the point of *slipping* down the plane and also of *overturning* upon it; what is the height of the mass? N.B. The limiting angle of resistance between cast iron and oak is 26°.

6. What is the least force which will draw a cubical foot of cast iron, whose specific gravity is 7.079, up an inclined plane of oak whose inclination is 14°; and what is the least force which will draw it down the plane?

7. What should be the circumference of the rope used in drawing the body in the last example up the plane, supposing it of the best quality? Supposing the mass to be moved at the rate of $2\frac{1}{2}$ miles an hour, how many horses power will be consumed in moving it?

8. Show how the relation of two parallel pressures applied to a body moveable about a cylindrical axis may be determined when they are in the state bordering upon motion; the friction of the axis being considered.

9. A power, P, raises a weight, W, by the *intervention of a system of* two equal *pulleys, one of which is fixed*, and the other moveable. The axes are of cast-iron, turning in collars of wrought-iron. The radius of each of the pulleys, measuring to the centre of the cord, is six inches, and that of each of the axes one inch. Determine the relation between P and W, the friction of the axes being considered, and the weight of each pulley being 6lbs. N.B. The limiting angle of resistance between wrought-iron and cast-iron is 11°.

10. Determine how many pounds a man (working eight hours a-day) can raise 10 feet per minute, using the above system of pulleys; and how many pounds he could raise at the same rate, using only the single fixed pulley. N.B. The dynamical effect per minute of a man working as above is 3,700.

11. The beam of a balance is of cast-iron, and weighs 2cwt.; its fulcrum is a cylindrical axis of wrought-iron, two inches in radius; and its scale pans are suspended from similar cylindrical axis, each $1\frac{1}{2}$ inches in radius, and whose centres are three feet apart; the centre of the central axis is exactly half way between the other two. What weight placed in one scale pan of this balance will weigh down a ton placed in the other?

12. Show how the force lost in the stamping-engine by the friction of the wiper upon the tongue of the stamper, and of th stamper upon its guides, may be deter mined.

13. A rope passes horizontally over 100 pulleys, which support each 80lbs. of it, and weigh each 20lbs. The radius of each pulley is one foot, and that of its axis one inch; the axis is of wrought-iron, turning upon cast-iron. Determine the relation between a tension, P, applied to one extremity of this rope, and one, Q, overcoming it at the other.

14. An engine is required to raise from depths of A, B, and C fathoms respectively, *a*, *b*, and *c*, cubical feet of *water per* minute; find an algebraical expression for the horse-power of the engine, allowing $\frac{1}{8}$ for friction. Supposing the diameter of the piston of this engine to be D inches, the mean pressure per square inch upon it P lbs., and the length of stroke L feet, how many strokes must it make per minute?

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal* for October and November.]

IMPROVEMENT IN FIRE ARMS, *Samuel Adams, Springfield, Massachusetts.*—The main object of this invention is said to be the combining in the same barrel, a rifle and a smooth bored gun. The gun is to be of

that kind which receives its loading at the breech, by the insertion of a metallic cartridge into a smooth bored gun. When it is desired to convert this gun into a rifle, a barrel is to be inserted at the breech, which will fill the bore of the smooth gun, and project beyond its muzzle, where it is to be drawn up and secured by a screw ferule. A projecting rim on the rear end, is at the same time drawn against the shoulder on which the metallic cartridge was received. When used as a rifle, a movable sight is to be brought into action.

Claim.—"What I claim as my invention is the combining of one barrel within the other, in manner, and for the purposes herein set forth and described. I also claim the making the back sight of a rifle to turn on a pivot, in manner, and for the purpose set forth."

We very much doubt whether the manufacturing of combined guns upon the above plan, will ever be carried to an extent which will enable the patentee to repay the cost of a patent, as it seems to be one of those whimsies which may afford personal gratification to an individual, but is not likely to come into extended use.

Annular saw for sawing timber, *Robert Grant, Baltimore.*—This circular saw is to consist of a flat ring with the teeth upon its periphery. It is in fact like the common circular saw with its middle portion removed so as to leave a rim of two, three, or more inches in width. The saw is to be placed in a suitable frame furnished with friction rollers, which bear against its inner edge, and support it. In order to drive it, conical friction rollers are made to bear against its sides, opposite to each other, and these are to be driven by a band, or gearing.

Claim—"What I claim as my invention is the annular saw for cutting timber, and the arrangement of the adjustable friction rollers, and bevelled wheels, in combination with, and for the purpose of driving, the saw, as set forth."

We believe that this saw is new in its construction, and it is well calculated to remove the difficulty of *buckling*, from elevation of temperature in the cutting edge. It appears likely, however, that its defect will be a want of stiffness, and that it will be liable, therefore, to chatter when in use.

Spark arrester for locomotives and other steam engines, *Benjamin Briscoe, City of Detroit.*—I surround the chimney of the engine by an inverted cone of sheet iron, the lower end of which embraces, and is attached to the chimney at the distance of *three feet, more or less*, from the top of the *said chimney*, its upper edge rising above *the top of the chimney* to the height of from twenty inches to two feet, where its diameter may be three times that of the chimney. To strengthen the upper edge of this inverted cone, and to sustain an inverted cone of wire gauze, I affix thereto an iron ring, which is so constructed as to answer another useful purpose, to be presently described. In the accompanying drawing, fig. 1, is a ver-

Fig. 1.

tical section of the chimney, and its appendages; and fig. 2, a top view of the ring, with the ribs which are to support the wire gauze. A, A, is the chimney; B, B, the inverted cone of sheet iron surrounding it, the space between it and the chimney serving as a receptacle for the sparks and ashes; there being sliding or other doors *a*, *a*, provided for removing them when necessary. C, C, is the iron ring which surrounds, and is attached to, the upper edge of the cone B, B. This ring I usually make about three inches wide, its outer edges being attached to the cone, in consequence of which it projects inwards, lessening the diameter of the opening about six inches. Its lower flat side thus presents a space against which the sparks strike, which are conducted up to it by the inverted cone of wire gauze, where, not being subjected to any draught, they fall readily into the receptacle.

D, D, is the inverted cone of wire gauze, which is attached at its upper edge to the hoop C, C, and at its lower edge to a disk or piece of sheet iron E. This lower end may be about ten inches above the top of

the chimney. F, F, fig. 2, are ribs of iron

Fig. 2.

to which to attach the wire gauze. The part which I have denominated the inverted cone of wire gauze may be a segment of a sphere, as well as of a cone, and may be made to produce the same mechanical effect.

The sparks as they rise from the chimney strike against the wire gauze, and from its position they are carried by the draught up its inclined sides until they come into contact with the under side of the ring, whence they fall, as already stated. The inner edge of the ring may be made to incline downwards, in the direction of the wire gauze. The difference between the action of the draught upon a flat, or a concave surface, in detaining the sparks, and the action upon such a one as I have described will be apparent; as its tendency in the former case is to cause them to adhere to, and in the latter to slide upon the surface, thus perpetually freeing it from their obstructing influence.

ATMOSPHERIC SODA WATER FOUNTAIN; *B. Swan, New York.*—An air vessel, or receiver, like the common soda water fountain, is prepared, and placed in a vessel containing ice, to serve as a refrigerator. Into this air vessel is to be forced, by means of a suitable pump, an alkaline solution, made by dissolving an ounce of super-carbonate of soda in every gallon of water. The forcing in of this solution will condense the atmospheric air within the receiver, and cause the solution to flow out when required. Any of the usual varieties of sirop are to be used, with the addition of seven ounces of tartaric acid dissolved in every gallon thereof. About an ounce of this is to be poured into a three-quarter pint tumbler, and the alkaline solution then drawn into it.

The claim is to "the placing of a carbonated alkaline solution in a suitable vessel for containing the same, and causing it to pass, as wanted, into a receiver, or air vessel, by means of a force pump, thereby condensing the atmospheric air contained therein, and thus causing it to operate like the common soda water fountain."

SWINGING BRIDGE, *Abner R. Ring, New York.*—This bridge is to pass over canals, and is to be opened by the contact of the boat, after the passing of which it is to re-adjust itself. The bridge is to be in two parts, there being a pier in the middle of the canal to support the inner ends of the two sections. These sections turn on pivots on either side of the canal, there being friction rollers, and a circular ring, or hoop, of iron, bearing upon them to sustain the bridge. The boat in passing comes in contact with friction rollers on the ends of levers, which levers give the first impulse in the opening of the bridge. After the passing of the boat, the bridge is to be closed by the action of a volute spring, aided by a counter weight.

Claim.—"What I claim as my invention is the combination of the lever and springs for giving the first impulse to the opening of the bridge; the mode of preventing the jar when the boat comes in contact with the bridge, and guiding the boat through by means of the springs and rollers; and the mode of closing the bridge by means of the combination of the volute spring and counter weight, as described."

The plan appears to be devised with skill, and in a model the operation will be very promising, but beyond this we want for confidence. The structure must, we think, be very light indeed, which could be made to act in the way proposed. If the experiment has been successful, however, we shall be glad to hear of it, and to give it publicity.

NOTES AND NOTICES.

Testing by Electricity.—M. Rousseau proposes to ascertain the purity of certain substances, and to detect any adulterations in them, by measuring their conducting power for electricity. Some years ago he described a simple apparatus by means of which the purity of olive oil might be tested on similar principles. He now states that by these means any adulterations in chocolate or coffee may be readily detected: he finds that pure chocolate is a non-conductor or insulator of electricity, but that in proportion to the quantity of farina or fecular matter with which it is adulterated, the more easily does it conduct electricity; and in the same way he states that coffee is an insulator, whilst chicory, with which it is often mixed, is an excellent conductor, and hence the presence of only a small quantity of that substance is easily detected in coffee by its increased conducting power. M. Rousseau also considers that this test may be applied with advantage to the examination of pharmaceutical extracts and preparations, because they very much differ in conducting power, and therefore any mixture or adulteration will be readily discovered.

Trunks of Trees.—In altitude, or length and diameter, the stems or trunks of trees present the most varied and contrasted features. According to Von Martius, there is a palm that grows fifteen feet high, with a trunk not thicker than the finger. A

comparison, indeed, between the stems of various plants would, in some case, afford examples of widely diverging extremes. The *Scirpus Capillaris* is not thicker than a hair, and some as fine as a gossamer thread, while the trunk of the paobab is nearly 100 feet in circumference. Even canes and reeds, in foreign climates, sometimes rush up to an incredible altitude. Dr. Walsh cut down one of the canes in the Brazils, called with its congeners "grass of the thicket," and it was found to measure ninety feet in length; it was exquisitely polished and sharply pointed, and felt "lighter than a cart-whip." Amidst the dense gloom of the thicket, and struggling for existence, there is a reed which, though not thicker than a goose-quill, mounts upwards, and overtops the loftiest trees of the forests of India. The "Coque" of Chili threads the woods to an extent of 600 feet.—*Economy of Vegetation.*

Letter Weighing Machines.—The change in our Post Office regulations has set so many ingenious men speculating on the best and most simple contrivance for weighing letters, that the public, like ourselves, is a little perplexed to decide between their several claims and pretensions. Some have proposed to themselves different objects—thus Mr. Hooper, whose instrument we lately noticed, had evidently consulted the breeches' pockets of the thousands who desired only to attain an instrument at small cost: while Mr. Osler, of Birmingham, so well known for his anemometer, and who now puts in a claim to be heard, has taken the select few into consideration, and has produced one, which for beauty and simplicity, we recommend to the attention of the ladies as an ornament to their drawing rooms. It may be briefly described as an upright glass tube, containing mercury, into which is plunged a graduated piston, so that on placing a letter on the top of it, the piston sinks into the mercury in proportion to the weight of the letter, which is ascertained from the graduated scale.—*Athenæum.*—[Mr. Osler's balance appears to be the same as one invented by Mr. Miller of Dundee, and noticed in our Magazine of the 21st ult., No. 854.—Ed. M. M.]

Varnish for Iron or Steel.—The *Nantucket Inquirer* states that "A permanent varnish is obtained by rubbing iron in a state nearly red hot, with the horny hoofs of cattle, which were previously dipped in a small portion of oil; this process is asserted to afford the best defence from the destructive influence of air and humidity."

The Largest Iron Sailing Vessel in the world was launched on Tuesday the 7th Jan. from the building yard of Messrs John Ronalds and Co. of Aberdeen. It is named the "John Garrod."

The length of this noble vessel over all is.. 150 feet.
Breadth .... 31 do.
Depth..................................... 21 do.

And measurement upwards of 800 tons. It is believed that on 14 feet water she will carry 1,400 tons weight. She will be full-shipped rigged; the standing rigging of patent metallic cordage, the lightness and other advantages of which are not yet sufficiently known here to be fully appreciated. —*Aberdeen Journal.*

Steam-engine Furnace Flues.—Sir,—There appears to be a notable error in Mr. Hartop's paper on flues and chimneys in your useful magazine for last month, where he states that the water at the upper part of a boiler is hotter than at the bottom. Now it is generally believed that the reverse of this is the fact, and that the temperature of the water increases at greater depths in the proportion of one degree of Fahrenheit for every ten inches, measuring from the surface downwards. If so, Mr. Hartop's conclusions respecting the Cornish boilers must be erroneous, yours, &c.,—Penny Post.

Norwich Port.—Sir,—I find upon reference to the advertisement in our papers relative to "Norwich a Port," the works are to sell, and not to let, as assumed in my communication sent yesterday, and I beg of you to correct it accordingly. I am, &c.
Norwich, Jan. 16, 1840. W. Thorold.

Mr. Jones's Clinometer.—Sir,—In answer to Mr. Evans's courteous epistle, I beg to inform him, that in the year 1837, I forwarded to the "Royal Cornwall Polytechnic Society," an excellent working instrument in every particular the exact resemblance of the engraving that appeared of it in your columns a few weeks since, together with an improved trough for washing tin and other metallic ores, by which any loss in the process is completely prevented, and some new machinery for facilitating the ascent and descent of the "Cornish mines," an engraving and description of which will be found in the Society's report for that year, and for which the Society awarded me a first class honorary medal. I merely mention these circumstances to show that the Clinometer is only one of the many objects to which I have devoted my attention, and that so far from pirating the invention, I was wholly unconscious of *any* instrument having been made for the *specific purposes for which* my invention is intended. I am, &c. Wm. Jones.

Values of Various Fuels.—From an extensive series of experiments lately made, it has been ascertained that one pound of Wallsend coals will impart one degree of heat to 8,000 lbs. of water; of Llangenech, to 9,000 lbs.; charcoal, to 10,000 lbs; and of anthracite, to 12,000 lbs.

Russian Manufactures.—To show what progress Russia is making in manufactures, it may be stated, that there are no fewer than one hundred and eighty-seven manufactories of various kinds in or near the capital. Many of these are worthy of especial notice, but we can mention only the celebrated and interesting Alexandrofsky Zavod, which stands about six miles from the city. This is one of the largest manufacturing establishments to be met with on the continent, there being about 3,000 free labourers employed in it, and 1,000 boys and girls from the Foundling Hospital. There is also a house of convalescence for patients from the Foundling, and an hospital for the sick of the place. Cotton, linen, table-cloths, quilts, sail-cloth, and playing cards, are here manufactured on a very extensive scale; the men being employed in the hemp and flax departments, and the children on the cotton and linen. There is also a very extensive fabric of weaving and spinning machinery, steam-engines, &c.: but we were given to understand that (as we have usually found regarding such establishments abroad) the Emperor can procure steam-engines, and all kinds of machinery, much cheaper from England than he can make them at home. The superintendents are from England; and the whole of the works are under the management of a gentleman of the name of Wilson. * * * Though comparatively little has been doing in them of late years, a visit to the Porcelain Works will also reward the stranger. We have seen some vases which were made here, as large and as beautiful as any of the famous Dresden manufactory. The painting, in particular, is most exquisitely finished. The Glass Works of St. Petersburgh have long been celebrated. Some of the largest mirrors in Europe have been made here, and the labours are still carried on with great spirit.—*Bremner's Excursions in Russia.*

Erratum.—In page 249, col. 1, line 5, from the bottom, for "but to any two places in the same longitude, and not from the equator," read "but to any two places in the same longitude, and not *far* from the equator."—J. N.

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Mechanics' Magazine,

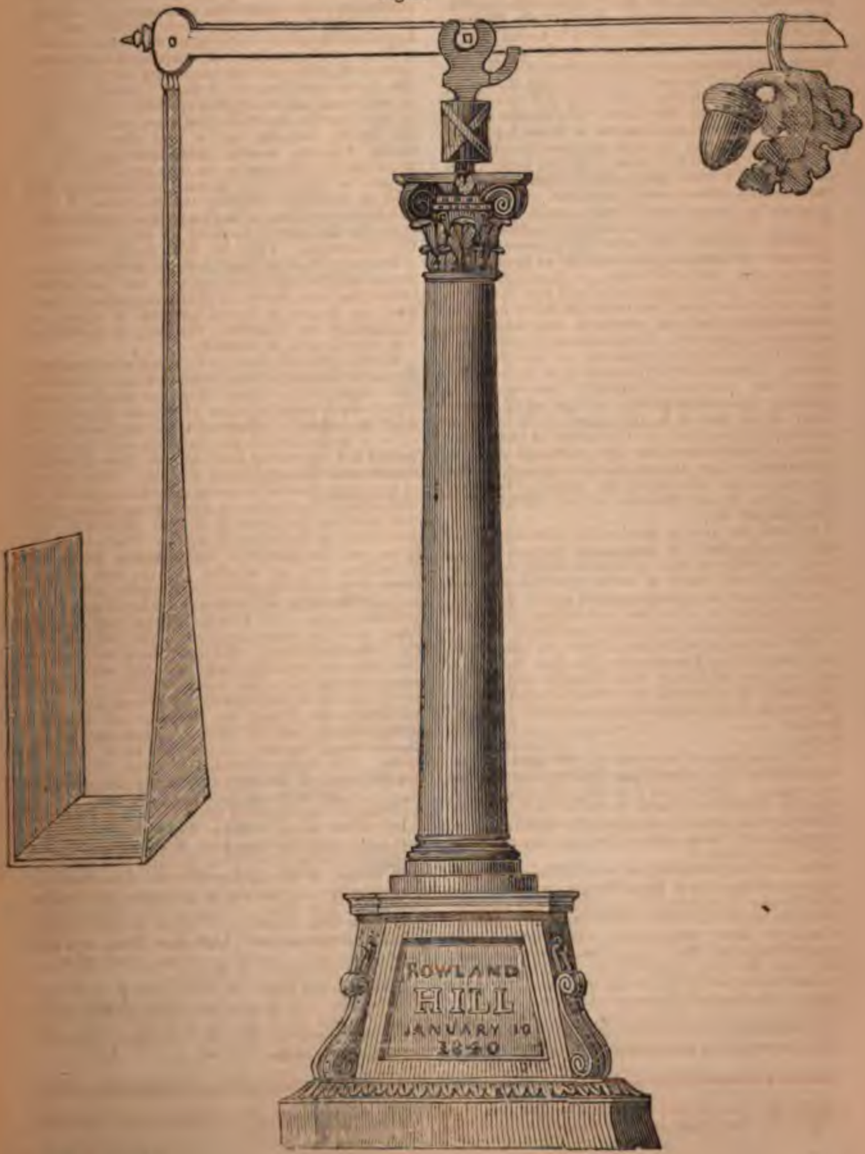
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 860.] FRIDAY, JANUARY 31, 1840. [Price 3*d*.

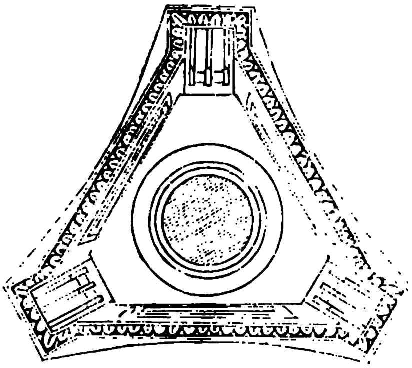
Printed and Published for the Proprietor, by W. A. Robertson, No. 166, Fleet-street.

KING'S REGISTERED COMMEMORATIVE LETTER BALANCE

Fig.1.



2.



3.

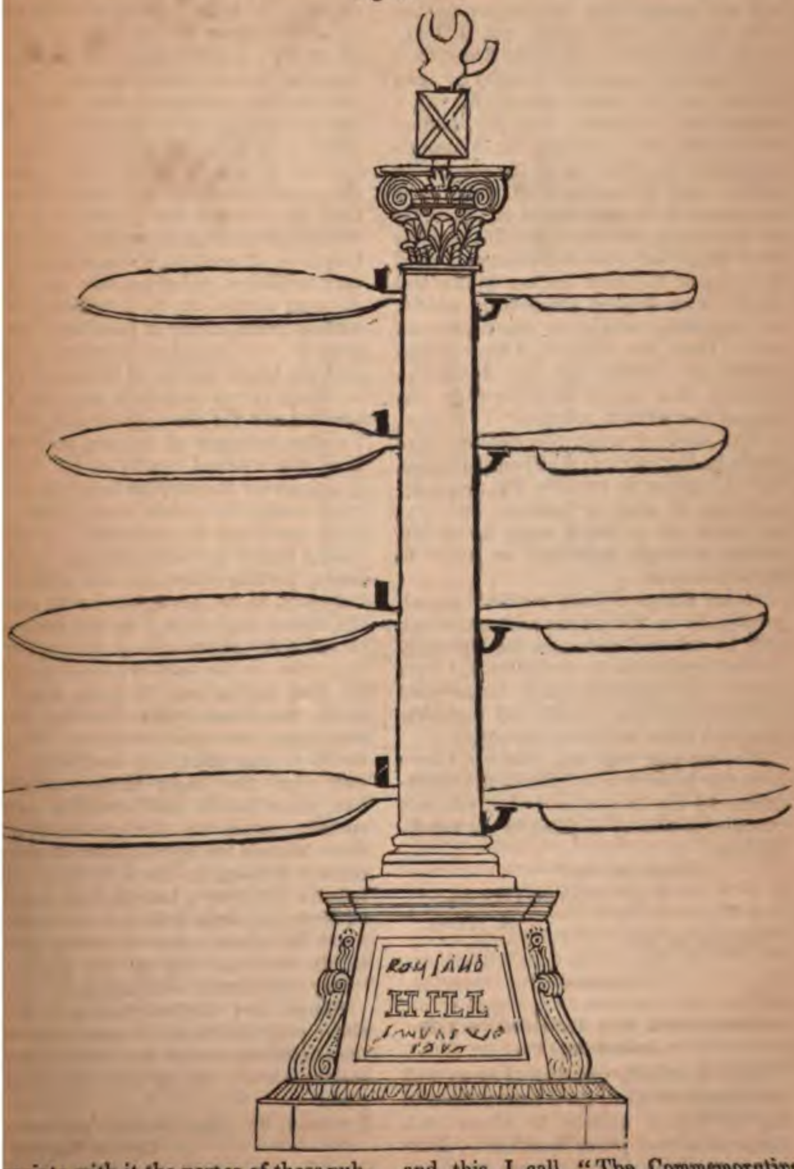
4.

Sir,—The new Post Office regulations have already engaged the attention and ability of many ingenious men, and as the result, a variety of machines for ascertaining the weight of letters previously to posting, are now before the public. It therefore seems necessary to assign a reason for introducing to your notice and that of the public, through the medium of your widely-circulated Magazine, another letter balance. My object in designing the one now presented, was that there may be something in so necessary an article *commemorative* of the various improvements in the Post Office establishment.

I consider that the improvements *made for the more speedy* and *safe* conveyance of letters by the mail coaches projected and carried into effect in 1784, by Mr. J. Palmer, were a great national benefit, and the uniform penny postage plan, by Mr. Rowland Hill, is likely to prove a great and lasting advantage to the commercial interest of this kingdom, and that the year in which it received the Royal Assent will be a memorable event in the history of Queen Victoria. You may readily perceive from these observations, that I am of opinion some *public monument* should be erected by which both the present and future generations may know to whom they are indebted for these arrangements. When I look at the various pillars in the country, and the splendid and appro-

iate monuments in St. Paul's and West-inster Abbey, to the memory of those ho have distinguished themselves as *'arriors, Politicians, Statesmen, Poets,* :., I have been led to think that some iblic testimonial is due to those, who, in the present day, have employed their time and talents for the improvement of the internal communications of our beloved country; but as *I* cannot erect a public edifice—I must be satisfied with constructing a useful article, which will

Fig. 5.



sociate with it the names of these pub- benefactors, *which may be possessed every family in the United Kingdom,* and this I call "The Commemorative *Letter Balance.*" By a reference to the drawing, (see front page), you will per-

ceive I have aimed at uniting utility, architectural correctness, and national record. I have chosen the tripod base, (see plan, fig. 2), as affording three tablets; on the front tablet I have placed the the name of ROWLAND HILL, and the day on which his plan of uniform postage was carried into operation; on the left, fig. 3, a mail coach, and J. PALMER, with the date when the first letters were sent (as projected by him) by mail coach; on the right tablet, fig. 4, a crown and VICTORIA, with the date on which the bill received her Majesty's sanction; the pillar is of the composite order; and the fasces, with which it is surmounted, is emblematic of the union of the people (for whose benefit the plans were projected); the rod balance is used as being of the most ancient kind; and to give it an English character, I add for its regulating weight, an acorn and oak leaf. Thus you will see, I have endeavoured to combine all the distinctive features that might be elaborately displayed in a nationl column.*

The mode of using this balance letter needs no instruction; I will only observe, that the pillar is suitable for every description of scale or balance, and may be made on a larger scale for public offices, to weigh from half an ounce to sixteen ounces.

In my design I have confined myself principally to the pillar and base, which may be adopted with any description of balance applied to it; and in fig. 5, I have shown one variation, which forms what I think is a very simple and complete plan of a letter weighing apparatus.

Hoping you will not consider I have been too explicit or tedious in the explanation of my design, and that you will consider it worthy a place in your publication.

I remain, Sir,
Your obedient servant,
S. KING.

Bath, Jan. 20, 1840.

SUBSTITUTE FOR HOG SKINS FOR SADDLE SEATS.

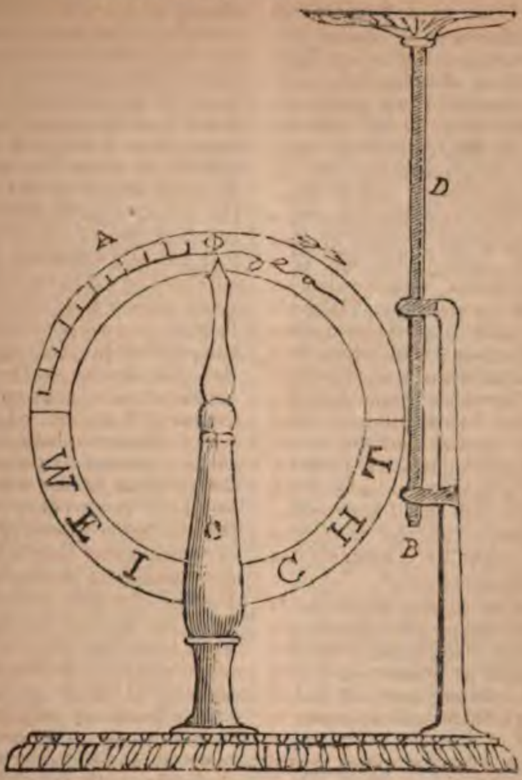
Sir,—It affords pleasure to every well constituted mind to give information to any portion of society to whom such disclosures may prove beneficial. During my commercial travels in the leather trade for a long period in the time of the last war, I found the article of hog skins used for the purpose of covering saddle seats, to be very scarce and dear, so much so, as to compel many saddlers in some parts of England and Wales (especially the latter,) to have recourse to an article known by the name of facing skins, *i. e.*, a particularly clear and good coloured tanned sheep leather, as the best and only substitute they could procure for hog's skin for saddle seats. Now every person acquainted with the difference in quality of the latter article compared with that of a pig's skin, is aware that the sheep's skin possesses a very slightly streaked grain surface, and is of a looseness of texture, which renders it a very inefficient substitute for an article *the most marked in the peculiarity of its natural grain*, of any of the whole animal creation. It therefore occurred to me, that the larger species of Greeland seals, of which great numbers were at that time tanned for shoemakers use, would, from its strength of texture, as well as from the marked beauty of its natural grain, answer the purpose better than any other leather for saddle seats, where hog skins could not be procured. I immediately found my anticipations realized, by my getting orders for the article extensively, in all parts, but being out of the leather trade now, I do not know any thing of the prices, nor of the supply of hog skins in the market; but I remember they sold about 36 years ago at a most exorbitant rate, besides being sometimes so scarce as not to be procured at any price. It sometimes occurs that the larger Greenland skins bear slight marks and scratches on the surface, owing to the predilection of these animals for fighting, but there are some, belonging no doubt to the civilian tribes which bear a beautiful unblemished face; but large seals are not used so much for shoes now as formerly, owing to the skin not taking the polish of "Day and Martin's brilliant jet."

Should any similarity on any of the above points occur at the present period, the above information may perhaps prove serviceable to some parties in the leather trade.

I remain, Sir, your obedient servant,
ENORT SMITH.

* A very happy idea, very cleverly carried out.—ED. M. M.

CIRCULAR WEIGHT LETTER BALANCE.



Sir,—As you have favoured me by inserting my last communication on the subject of a letter balance in your number of the 4th instant, I feel emboldened to offer one more plan, (the best of three or four which I have recently contrived). The annexed sketch is on a scale of half an inch to one inch.

A flat circular box of four inches diameter, and half an inch thick, is to be turned, so as to leave a space within, of rather more than a quarter of an inch in depth; within this box (say of mahogany) is to be placed a semi-ring weight, as thick as the space between the two sides of the box will admit of, and from ⅜ths to half an inch in breadth. This being achieved, the whole is to be suspended on a small pivot or axis, and kept free from any friction of the arm C, and its opposite, by means of a small projecting shoulder. A fine cord of silk, or the like, is then to be attached to the wheel, or box, any where about A, and then brought round part of the circumference, in the direction of the small arrow, passing the point of contact of the wheel and the shaft D, down to the lower extremity of the shaft at B, where it is to be fixed.

This being done, it is evident, that a letter placed on the dish will force down the shaft and turn the wheel a certain distance according to its weight.

It is requisite that the arms, or rings through which the shaft moves, be quite smooth, and sufficiently large, and the shaft itself as true as possible, in order to avoid too much friction.

The idea of employing a semicircular weight, occurred to me from the consideration of a mercurial letter balance, which, though impracticable in itself, furnished the notion of having a fixed metal revolving on an axis, in place of the mercury in a bent tube.

I am, Sir, your obedient servant,

J. B.

Jan. 13, 1840.

MR. RENNIE'S COMPARATIVE EXPERIMENTS ON PROPELLERS.—MR. HOLEBROOK IN REPLY TO "J. M."

Sir,—I beg permission to be allowed to trespass a little further on your valuable space with the following observations in answer to the reply, inserted in your last number, of your correspondent "J. M.," to my "remarks on Mr. Rennie's comparative experiments on propellers of different kinds," especially as these remarks, in consequence of some misapprehension on my part, and fresh information and some corrections of errors in the results of the experiments, afforded by your correspondent, are not so strictly applicable, or of so close a character as I could now wish them to have been.

In making the amendments I did to the conclusions deduced from the first table of experiments, I had no idea of rendering the conclusions thus amended, expressions of general laws; indeed I thought I made this plainly appear by stating that the conclusions thus amended were "altogether useless," and "of no value." If, Sir, the original conclusions were only intended, to use your correspondent's own words, as "an abstract of as was exhibited in the particular cases investigated," I could have no objection to the assertion of them; but I imagined, what most persons would have also imagined, that though not expressions of general laws, they were intended to be used as foundations of such laws; and perceiving, from their extraordinary character, that they were not fitted for such a purpose, I took the liberty of, perhaps, imperfectly showing their inapplicability. But your correspondent does not always divest himself of the importance which I attached to them, because he says, in opposition to my opinion of these conclusions, that, "It is surely of use to show that, while other advantages are gained by modifying the form of float, the wheel's resistance, or its hold on the water, is not sacrificed; and again, that its liability to be injuriously affected by varying depth of immersion is lessened." Why, Sir, this is but re-affirming the conclusions in different words. If these words are meant to convey what they commonly would convey, asserting for the trapezium floats the valuable properties attributed to them by the conclusions, it shall be my endeavour to show that these attributed properties are only due to the isolated character of the conditions of the experiments from which they have been ascertained, and are not properties which can be attributed to these floats, when the conditions of experiments are of a less unequal nature. That *your correspondent is*, in another instance, *of my opinion, may be shown* by quoting *again his own words*, when he says that the "conclusions applicable to the first table, are not intended to be *invariably* applicable to all circumstances." The note at the foot of page 275, also shows the general inapplicability of these conclusions; because, though the rhomboidal floats, in the case therein mentioned, worked at more advantage than in the experiments recorded in the first table, yet we find by this note, that the resistance of the rhomboidal floats was *two-thirds* of that of the rectangular floats, the area of the two floats being as one to two; while in the experiments recorded in the first table, the area of the two floats being in the same ratio, the resistance of the rhomboidal floats is *the same* as that of the rectangular floats. If other reasons did not exist to show the want of utility of the conclusions in dispute, as assertions of the proper qualities of the trapezium floats, the discrepancy in the results just mentioned, would be sufficient to shake confidence in these conclusions. But I think I shall succeed in showing that every part of these conclusions would be upset by only an alteration of the conditions of experiment, and in proving that the advantage is in every respect, under such circumstances, and, by consequence, under all other circumstances, with the rectangular floats.

Your correspondent has corrected the last 12 and 9 in column 3 of the first table, by substituting for these figures, 30 and 14. "A few circles drawn and a trifling degree of reflection," makes me think he might also have advantageously altered the first 12 and 9, by substituting 18 for the 12, and some smaller number than 9, for the 9. I say this, because, with the first immersion, three rectangular floats will be completely immersed, while not one of the three lower trapezium floats will be entirely immersed. Let the table, however, stand as your correspondent has left it; for it is then more intelligible than it would be with my further suggested corrections. In my previous remarks upon the experiments under consideration, I endeavoured to show that the conclusions deduced were not useful, because the conditions were not equal or favourable to the rectangular floats. A few words will show that the conditions were not equal. The circles within which the paddles revolve, in the experiments recorded in the first table, were, it is true, of the same diameter, but the breadth of the wheels, in the cases of the different floats, were as one to three, and besides, there was vast difference in the manner of placing the two sorts of floats upon the wheels; the trapezium floats being placed with their longest diagonals in a radial direction, while the rectangular

floats had their longest sides placed in an *entirely reverse* direction. In addition, the rectangular floats were of double the area of the other floats. It may, perhaps, be said that these variations in the conditions were so many advantages conferred upon the rectangular floats. Under some circumstances, they certainly would have been, but, I think I shall show that in the cases of these experiments, they are very objectionable boons; inasmuch as they are the cause of conclusions being drawn, extremely different from those which could have been deduced without them. In the experiments of the second and third tables, the different wheels have not only different widths, but also different diameters. Now, if conditions thus different can be said to be equal conditions, I confess I should be glad to know at what point inequality of condition begins.

Let us now see whether the conditions were favourable to the rectangular floats. If, contenting myself with a wheel of the same diameter and width as that used in the case of the trapezium floats—if using the same number of rectangular floats as are used of the trapezium floats—if satisfied with exactly the same area for each rectangular float as is contained in the trapezium float; and if, by placing the rectangular floats differently to the manner in which they were placed in the experiments under discussion—I say if, under such more equal conditions, I succeed in showing that very different results would have been obtained, and very different conclusions have been deduced, I trust I shall be allowed to have shown that the conditions under which the rectangular floats were used, in the experiments in question, were not favourable to these floats.

Upon a wheel, of exactly the same measures in diameter and width, I should place the rectangular paddles as far from the centre of the wheel as the diameter would allow, these paddles being of half the length of those used by Mr. Rennie, but of the same breadth, consequently having the same area as the trapezium floats which were used. Such rectangular floats I would place so that their longer sides should be in a radial direction, while their shorter sides should be across the wheel. It is clear that the wheel thus fitted with rectangular paddles, would revolve in a paddle-box, exactly capable of receiving the wheel fitted with trapezium floats. Immersing a wheel thus fitted with rectangular floats, to the first degree of immersion, we should find three rectangular floats immersed, which would be equal to an immersed area of 9, just the same amount as is set down for the trapezium floats in the first *table; but, it may be asked, what would be the resistance?* Why, sir, here I am a little puzzled, because the further inaccuracy of the first table becomes evident. However, I think it will be allowed me that pointed floats, passing through the same circles in the water, could not be so much resisted as rectangular floats, occupying the whole width of the wheel. If, then, the rectangular floats be thus more resisted, what becomes of that part of the first conclusion which states the resistance to be *the same*, in the case of both floats?

Let us now see what will be the result upon a double immersion of the wheel with the rectangular floats. Two fresh floats will then become immersed, the total immersed area being 15; just about half that which was immersed in the experiment recorded in the first table, and, as the quantity immersed is about half that in the table, perhaps it will be granted me, to assume a resistance diminished by about one-half, or a resistance equal to 15. Placing this number, instead of 32, in the second column of table 1, we find the resistance *less*, in the case of the rectangular floats, than in that of the trapezium floats. What, then, becomes of the second conclusion to the first table, which states, "That when both kinds of floats are immersed to double of their ordinary immersion, the resistance of the trapezium float is only $\frac{1}{2}$ of the rectangular float;" the conclusion at which I have arrived, showing this resistance to be $\frac{1}{15}$ *more?*

Thus, sir, constrained to disregard the usual mode of estimating the effects produced by floats, obliged to be guided by a table, which even now cannot be perfect, perhaps I have succeeded in showing the whole value of the conclusions appended to the first table to be gone; because, "the trapezium shaped float having" *the same*, and not "*only* $\frac{1}{2}$ of the breadth, and" having the *same* and *not* "$\frac{1}{2}$ the area of the rectangular float, has" a *less* and not "*an equal* resistance;" and because "that when both kinds of floats are immersed to double of their ordinary immersion, the resistance of the trapezium float is" $\frac{1}{15}$ *more* than that, not "*only* $\frac{1}{2}$ of the rectangular float." And, if I have thus succeeded in consequence of greater equality of condition of experiment, it will be admitted that I have established my opinion, that the conditions of experiment adopted by Mr. Rennie, were not favourable to the best developement of the properties of the rectangular floats, considering the nature of the conclusions drawn from the experiments.

But there was a readier,' easier, and shorter method of showing that with a wheel, fitted with such rectangular floats as I have imagined, the resistance of the rectangular floats must be greater than that of

the trapezium floats. The centre of pressure, of the trapezium float, having so much less leverage than that of the rectangular float, the resistance of the water to the rectangular, must be greater than that to the trapezium float, even were the immersed area of each sort of float the same ; but, as it will be admitted that the immersed area of the trapezium floats is generally less than the immersed area of such rectangular floats as I have supposed, the resistance of the rectangular floats, as compared with the resistance of the trapezium floats, will, therefore, be generally, even further, greater. The resistance of the rectangular floats being greater, enables us to use these as effectually, for purposes of resistance, with a wheel of less dimensions, either of diameter or width, because the paring away of portions of the longer sides of the rectangular floats, will render a wheel of less breadth necessary, while, by placing these floats nearer to the centre of the wheel, allowing them to have the same width, the diameter of the wheel might be decreased. If, thus, in one case, we can obtain the same amount of resistance from rectangular floats, with a wheel of less size, that we can obtain from trapezium floats, with a wheel of a greater size, there is nothing of which I am aware, to prevent us from always obtaining the same resistance, when the size of the wheels is altered in the case of both floats. What, I would here ask, now becomes of the conclusions appended to the last table, respecting the saving to be derived by the use of trapezium floats, in the cost of wheels and paddle-boxes, and the lessened resistance of the wind, in the case of such floats being used ; seeing the advantage, in these respects, is with the rectangular floats, when used under favourable conditions,

It would be a waste of your space to offer any further observations upon the experiments of the second and third tables, liable as these, alike with those of the first table, are to the objection of inequality of condition of experiment, and different as the results of experiments, conducted on more equal conditions, would be from those recorded.

With respect to that part of your correspondent's communication, contained in the note at foot of page 275, I would observe, that the vanes upon the instruments, to which your correspondent refers, are of such a size in the square form, and so closely approach the axle to which they are fixed, and revolving, as they did, continually in water, that, even if such an instrument can be said to be a good indicator of the lateral *action of water, it is totally inapplicable, as a guide, to direct us to* the best form of a float for a paddle-wheel, operating as a float of such a wheel necessarily must, under such different circumstances. I may, perhaps, be allowed to suggest, that a trial of such an instrument, under altered measures, might possibly have been attended with less extraordinary results.

Even if your correspondent succeeded in establishing his proposition that, with a trapezium float of a given *area*, a greater resistance could be obtained than from a rectangular float of the same area, which from what has been before advanced, would be rather difficult, I would ask of what worth would the proposition be, when we consider that we should require twice the space within a wheel, wherein to place such a float ! The point I should conceive to be worth establishing would be, that within a given space between the framings of a paddle-wheel, we could place such an area of float as would give an increase of resistance, without, at the same time, crowding the floats upon the wheel, which, your correspondent knows would not give an increased resistance ; and even if it could, what advantage would that give to trapezium floats, seeing that increased resistance might also be obtained for the rectangular floats, by placing more of these upon the wheel ? Whatever defects, however, the trapezium floats may have, they must be confest to be capable of obviating, in a great measure, the vibration and back-water, attendant upon rectangular floats ; but, whether this advantage will be considered equivalent to the comparative non-effectiveness of these floats, in other respects, public opinion must decide.

Your correspondent seems to think that, attentively as I examined the last table of experiments, I still failed to notice a note at the foot of the page, the tendency of which note was, he appears to think, in favour of the trapezium floats. Now, sir, I did observe this note, and seeing that it rather favoured the rectangular floats, and not wishing to estimate the value of it, I passed it by. Of this, as I think I was throwing away a trifling advantage in favour of the rectangular float, your correspondent has no reason to complain. If he examines the table, he will find that the resistance is greater in the case of the trapezium floats, than in that of the rectangular floats, and yet the useful effect is less. It appeared to me, that if any allowance was made for the parts of the floats cut off, the resistance would be increased, and, as the excess of resistance of the trapezium floats, as shown by the table, did not appear favourable to the trapezium floats, I thought the increase of resistance, due to the parts of the floats cut off,

would render the results still less favourable to the trapezium floats; and I now, therefore think, as I before did, that I conferred an advantage on the trapezium floats, in not noticing the note.

Permit me again to apologize for trespassing so much on your space, and,

Sir, to subscribe myself

Your most obedient servant,

J. P. Holebrook.

168, Devonshire-place, Edgeware-road,
Jan. 23, 1840.

PROVISION AGAINST SHIPWRECK.

[From the Sixth Report of the Cornwall Polytechnic Society.]

Adams's Life Boat.—This boat is built with two bows, so that both ends being alike, she is always in a position to advance or retreat, which change of direction is most readily effected by the men turning round and sitting on the opposite sides of the same thwarts, and pulling from a different set of thowels, which are fixed for this purpose; Mr. Adams thinks this can be performed in much less than a minute, and the boat may immediately proceed in the opposite direction without the risk of winding or backing. It is proposed that she shall have a crew of eight men, six rowers, and two steerers, one at each end, with an oar, which is said to be preferable to a rudder for this purpose, and it gives great advantage to the man in the advancing end, not only to assist in steering, but by projecting his oar into the coming surge to break it, and thereby lessen the danger. Mr. Adams strongly recommends the following dimensions: extreme length, 30 feet; breadth, 5 feet 8 inches moulded, the extreme breadth midships, 5 feet 10 inches; depth midships, 2 feet $2\frac{1}{2}$ inches; height at each end or bow to the top of light stroke, 3 feet 6 inches. The mean breadth line is the segment of a circle from one end to the other, the radius of which is 41 feet 6 inches, and the three water lines are parts of circles of greater radii.

The fitting up is intended to be similar to that of gigs, with bottom boards and stretchers, the upper strake lined inside and out with good cork, and an air-tight vessel, which will contain from 30 to 50 gallons, made of tin plate, copper, or india rubber cloth, made to fit under the decks at each end, or even a quantity of good cork made to suit the place, and firmly secured close up to the deck. With these appendages, it is presumed the boat would not sink when full of water and her crew, or even with twenty men in her, and if by accident she gets athwart the sea, her cork and air fittings will tend to prevent her being turned over, or if turned over, she will immediately right herself. We understand it is now contemplated to build a boat of this construction, to be stationed at St. Ives.

Payne's mode of stowing Provisions within reach of the Crew of a water-logged Ship.

Mr. Payne accomplishes this object by forming the hatches into a large box or chest, which is divided into two or more parts, according to the size of the hatchway: this in a ship of three hundred tons burthen, would be of sufficient capacity to contain in tin cylinders of different sizes, about ninety gallons of water, two hundred pounds of bread, and one hundred pounds of preserved fresh meats, which will give an allowance of nearly three pints of water, one pound of bread, and half a pound of meat to each person, allowing five men and a boy to every hundred tons.

The principal advantage of this mode of stowing provisions for such an emergency, is, that it occupies no useful room, being quite out of the way of the cargo, and the accommodations of the captain or men, and not in any way interfering with the usual arrangements of a ship's deck; and so secure is the stowage, that if the masts had gone over the side, and the ship were full of water, yet while she held together, the provisions would be safe and available; and in the event of the crew being obliged to take to their boats, one of these provisioned hatches, with a compass, tomahawk, &c., packed in it, would be of immense value, as it would enable them in a short time, and with little trouble, to secure to themselves the means of subsistence for a fortnight or more, together with such instruments as would greatly increase the probability of their reaching timely assistance.

The tin cylinders containing the water are also deserving particular attention, as they may be rendered useful in many ways; they must be made perfectly air tight, and fitted with screw bungs, so that when empty, they become extremely buoyant vessels, which may be lashed to a boat or raft for the purpose of increasing its buoyancy, and, in fact, rendering it a life-boat, or having lines affixed to them, they may be of great assistance to the men in their endeavours to gain the shore by swimming; they may also become useful in sending a line on shore from a stranded vessel, by making a rope fast to one of them, and letting it drift; in most cases it would go in shore, when a temporary communication might be easily established with the land.

Preserved provisions are recommended, on account of their affording more nourishment,

which of course is an object, under circumstances where great fatigue must necessarily be endured.

Adams's plan of stowing Provisions within reach of the Crew of a water-logged Ship.

Mr. Adams proposes to place lead or zinc tanks in the spaces between the brackets of the stern frame: there are generally five such spaces, and the tanks filling them in a ship measuring a hundred and eleven tons, would be of sufficient capacity to contain one hundred gallons and three quarters, and would hold sufficient bread and water to supply seven men with a quart of water each per day, for 26 days. Tanks placed in this situation, would not, of course, be any obstruction to the ship's duty, and in most cases it would be the last place above water.

Phillips's Life-Boat.

In this boat there are seventeen air tight compartments, across the boat, the greater part of them formed by casing up the space under the thwarts; these compartments had no communication with each other, and in addition to caulking and pitching, it is proposed to line them with some air tight and elastic substance, in order to render them less liable to injury by external violence. From the numerous partitions, the boat would be exceedingly strong, and it is found by calculation, that even if two or three of the compartments were so much injured as to fill with water, the remaining ones would render the boat sufficiently buoyant in the most tempestuous sea. Mr. Phillips proposes to place two or three small air bags, under one of the gunwales within the boat, which, with the additional precaution of a heavy iron keel, would render it impossible, that the boat should remain in the water any length of time with its keel upwards.

He is also of opinion, that a boat with a straight deck, having the gunwale supported by rail work, would be more manageable against the wind; would be less cumbrous above water; would be less retarded by spray; and that water would not remain on board more than a second or two after it was shipped; this plan, he says, would also present more numerous and better situated life rails than any other.

The means of steering, and propelling, which accompanied the model, was suggested for river or canal navigation; it consisted of a paddle wheel under the stern, so arranged as to revolve by manual labour, and at the same time to allow of the steersman giving the wheel any required position about a vertical axis, so as to enable him to steer the boat by the paddle-wheel.

Mr. Phillips thinks that if any mechanical arrangement of this kind, were adopted for a life boat, it should be placed within the boat's length; but he would prefer for this purpose the peculiarly constructed Archimedian screw, a model of which was exhibited; one of these screws would be placed on each side of the keel, towards the stern of the boat, and entirely under the water. In the model above referred to, the vanes or threads of the screw, were placed at a differential distance from each other, increasing from the fore end backwards, the ratio of which increase, must depend on the probable rate of the vessel; the following reason is given for this construction: it is easily conceived that the fore end of the screw moving in still water, will, after putting it in motion, cause it to recede faster and faster towards the stern; and as the inertia is thus less and less, the latter end of the screw would revolve to little purpose, unless that part of its vane, were made to recede at a quicker rate than the current produced by the preceding portion.

ADMIRAL BULLEN'S SAFETY BELT, TO BE USED IN CLEANING WINDOWS.

Sir,—The accidents I have frequently heard of, as happening to persons engaged in cleaning windows, from their slipping, or overbalancing themselves while so employed, has induced me to offer to the public an invention of mine, that might, I hope, if adopted, be a means of preventing the recurrence of such accidents, or, at any rate, be likely to obviate a fatal result. I propose to fix, as firm as possible, two strong iron hooks, into the solid stone of the building—one on each

side of the window, on the outside, about four feet from the sill. On these hooks, I hook on, or take off, as required, a strong 2½ inch rope, about 5 feet long, with an iron thimble spliced in at each end. On this rope I place a loop, (a grummet, in seamen's language,) of the same sized rope as that on which it traverses. Through this loop I pass a strong leather strap, 2 inches wide, and 2-8th of an inch thick, fixed to a strong iron buckle. In using the apparatus, after the sash is thrown up, the rope is to be first hooked on to each of the iron hooks before mentioned, and *great care* must be observed that the thimbles rest on the *thick part of the hooks*, close to the stone into which they are inserted; for *there* the principal strain will be. The person employed then buckles the strap tight round his body, close under his arms—placing the connecting loop at his back. When he steps on the sill of the window, in getting out, he is to place himself *between the rope* and the window—that is, the *rope* must be on the *outside of him*. With this apparatus properly fixed, should he slip or lose his hold, instead of being dashed to the ground, he would (I trust) remain suspended till assistance could arrive to release him, or he could relieve himself, which I think he will be able to do.

I have proved the strength of my apparatus on two hooks fixed into a stone wall, and placing a piece of timber, to represent the sill of a window. This was accomplished on the premises of Mr. William Powell, (cabinet maker) who kindly assisted me in my experiments. We first suspended on the apparatus 474 lbs. dead weight; we then removed this weight and suspended 280 lbs.—first resting on the sill, and then shoving it off—by which action it fell 18 inches, with a violent jerk, similar to what a man would experience if he slipped and fell. I then buckled the belt round myself, and *purposely* slipped off the sill, when I was instantly suspended on the outside of the sill, with my knees hanging below it; from this situation, with the assistance of the rope fixed to the hooks, I easily regained my position on the sill; this I did twice without any difficulty.

I trust these severe trials will afford confidence to those persons who may use the apparatus, and I hope that God's watchful Providence will crown it with success.

I am, Sir,
Your humble servant.
JOSEPH BULLEN.

Bath, Dec. 20; 1839.

A A, Iron hooks fixed into the building. B, rope hooked on the iron hooks. C, connecting loop. D, leather belt. E, sill of the window.

ADMIRAL BULLEN'S SAFETY ROPE AND HOOK FOR PROTECTING MINERS IN DESCENDING AND ASCENDING THEIR PITS.

Fig. 1.

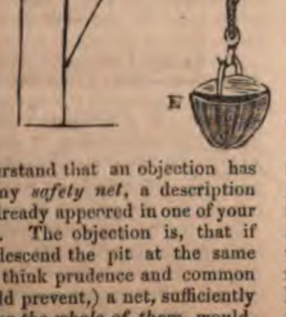
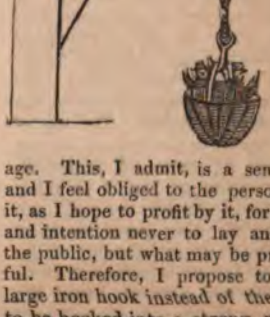


Fig. 2.



Sir,—I understand that an objection has been made to my *safety net*, a description of which has already appeared in one of your former papers. The objection is, that if *many* persons descend the pit at the same time, (which I think prudence and common humanity should prevent,) a net, sufficiently *large to envelope the whole of them*, would, *from its great size*, be inconvenient to manage. This, I admit, is a sensible remark, and I feel obliged to the person who made it, as I hope to profit by it, for it is my wish and intention never to lay anything before the public, but what may be practically useful. Therefore, I propose to substitute a large iron hook instead of the net, which is to be hooked into a strong rope loop, fixed into the working rope; of the same size and

strength as that to which it is joined, with an iron thimble fixed into it. This loop should be united to the working rope, just above the heads of the men, where they are placed in descending the pit; with this arrangement, should the working rope break, the men would then only be transferred to the safety rope, and there suspended (I hope) in perfect safety: and if the safety rope is kept properly tight and parallel with the other, the transfer from one rope to the other would be made, I think, without any jerk or commotion whatever. It is of *vital importance always to remember* that all the rope, &c., which is *below the loop*, is out of the protection of the safety rope; and should, therefore, be frequently examined respecting its security. But that part, however, will always be under the inspection of the men who descend and ascend the shaft, and their own safety, I trust, will make them vigilant. I send you a slight sketch of the alteration, which I hope is an improvement.

I am, Sir,

Your humble servant,

JOSEPH BULLEN.

Bath, Dec. 30, 1839.

Fig. 1. A, sheave over the pit's mouth; B, working rope; C, safety rope; D, hook, hooked into the loop on the working rope; E, corf, for bringing things from the bottom of the pit; ****, ligatures for fastening the two ropes together.

Fig. 2. A, sheave over the pit; B, working rope broken, and the lower end prevented from falling by the ligature *; C, safety rope, suspending the men after the working rope had separated; ****, ligatures to fasten the two ropes together.

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal* for October and November.]

IMPROVEMENT IN THE PROCESS OF TANNING, *Thomas Chase, New York.*—I make an air tight vat cistern, or case, of sufficient strength to sustain the pressure of the atmosphere when the air is exhausted therefrom; within this vat or cistern I suspend or lay the hides or skins, in any convenient manner, and completely cover the same with the tanning liquor. The top of the cistern is secured to the body of the vat or box by means of screws, or otherwise, with the intervention of leather or other suitable substance to render the same air tight. By means of an air pump, or other apparatus, affixed on or near the top of the cistern, I exhaust the air therefrom as completely as possible, and after this I work the air pump from time to time, as air will continue to be exhausted from the liquid, and from the pores of the skins, in consequence of the removal of the pressure of the atmosphere from the surface of the liquid. The expansion of the air in, and its extraction from, the pores of the skin opens them, and gives a ready admission to the liquor, or ooze, which in consequence penetrates to the interior of the skin, pervading its whole mass, and tanning it perfectly throughout. I sometimes, after having continued this state of exhaustion for some hours, admit the atmospheric air into the vat, so as to exert its pressure upon the surface of the liquid, allowing it to do so for a short period of time, that it may aid in forcing the liquid into the exhausted pores, after which I again work the air pump and remove the pressure. As occasion may require I renew the liquor in the vat by withdrawing it by a pump, or other means, and returning it to the reservoir of bark or other tanning substance, from which reservoir it is again freshly supplied by a tube, or other means, to the tanning vat. I also have a barometer, or gauge, connected with the vat, by which to ascertain the degree of atmospheric pressure.

After the tanning liquor has completely penetrated the hides or skins, and become incorporated with them, extra atmospheric or hydraulic pressure, (the latter of which I think the most convenient,) may be applied, in order to give the hides or skins an additional solidity or firmness. I do not prescribe any particular mode of constructing the vats or cisterns, there not being any thing peculiar in these, or in any other part of the apparatus, the whole being such as any competent workman can construct without special directions from me; such apparatus having been before known and used for various purposes, and not being of my invention.

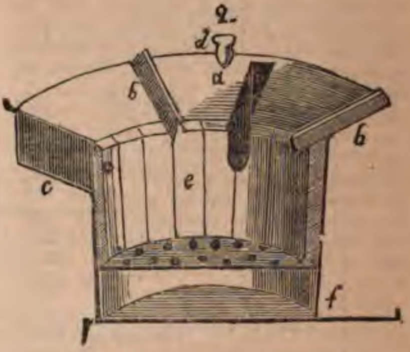
What I claim as constituting my improvement, is the application of the principles of exhaustion to tan vats, after the skins or hides have been laid therein, and they have been covered with the tanning liquor in the manner and for the purpose herein fully set forth.

PORTABLE FURNACE, *Jordan, L. Mott, New York.*—Fig. 1, in the accompanying drawings represents the furnace in perspective. Fig. 2, is a vertical section through the middle of it; and fig. 3 shows the rim or flaring part, with its appendages separated from the cylindrical, or body part, of the furnace, for the purpose of employing it in a manner to be presently described. These furnaces are usually made of cast iron, and they may be made either in one or two parts, the rim or flaring part *a*, *a*, being in the latter case attached to the cylindrical or body

part, by screws or otherwise. Upon this rim I form three or more ridges or projections *b*, *b*, upon which the cooking utensils are to rest, the height of these ridges determining the flue or space between the rim *a*, and the bottom of the boiler, or other

Fig. 1.

Fig. 2.



3.

utensil placed thereon. I also construct three hollow, or deep recesses *c*, *c*, into which the legs of iron pots may be received, so as to allow their bottoms to rest upon the ridges *b*, *b*, or instead of this recess I cut openings or slots through the said rims, for the same purpose. The cylindrical part *d*, *d*, I line as shown at *e*, *e*, with soap stone, fire clay, or other nonconductor of heat. The ash pit *f*, I usually make somewhat smaller in its diameter than the body *d*, thus leaving an offset, upon which the lining may rest at its lower end, when the furnace is cast in one piece. I allow the inner ends of the ridges *b*, *b*, to project within the edge of the rim, so as to cover, and in part to confine the lining in its place; when the rim is made separate from the body of the furnace, I allow the whole inner edge to project over so as to cover the top of the lining, and after completing the latter, attach the rim to the body, as before indicated. When the rim, with its appendages, is made separate from the body of the furnace, as shown in fig. 3, I employ it to cover and surround any boiler hole in stoves, furnaces, ranges, or other cooking apparatus to which it may be adapted, so as to fit them to receive the various kinds of utensils in ordinary use, as pots, kettles, boilers, &c.

I do not claim the mere making of the upper part of a portable furnace flaring, this having been previously done, but not in the manner above set forth; what I do claim, therefore, is the making of a rim or flaring part, projecting out from the upper part of a cylindrical, or nearly cylindrical, body; and having upon it ridges, to support the utensils placed thereon, in the manner, and for the purposes set forth. I also claim, the providing of the recesses, or instead thereof, the making of slots, in such rim, to admit with equal facility the legs of pots of various sizes. I also claim the making and using of such rims, or flaring tops furnished with ridges, or with recesses, or slots, or with both, to be adapted and applied to the boiler openings in cooking apparatus of various kinds.

LIST OF DESIGNS REGISTERED BETWEEN DECEMBER 24, 1839, AND JANUARY 29, 1840.*

Date of Registration.	Number on the Register.	Registered Proprietor's Name.	Subject of Design.	Time for which the protection is granted.
1839.				
Dec. 27.	150	T. Skelton	Beibazar fleece	1 year
27.	151	Davis, Brothers	Walking-stick with telescope	3
27.	152	J. Gillott and T. Walker	Letter weight	3
30.	153	Robert Rettie	Ditto	3
31.	154	Heeles, Gawthorpe, & Co.	Ribbon	1
31.	155	W. A. Robertson	Roller Calendar	3
1840.				
Jan. 2.	156	Cope and Austin	Table fastening	3
3.	157	Wood and Ogilvy	Carpet	1
6.	158	J. Ashton	Gun-lock	3
6.	159	J. Sugden and Son	Silk cashmere	1
6.	160	W. Lund	Letter weight	3
7.	161 to 169	W. Evans	Stained paper	1
13.	170	R. W. Winfield	Letter weight	3
14.	171	J. Yates	Fender	3
14.	172	H. Brooks	Wafer	1
15.	173	Carron Company	Fender	3
15.	174	Ditto	Stove	3
16.	175 to 188	Wilcoxon and Sons	Stained paper	1
16.	189 to 207	Turner and Williams	Ditto	1
22.	208	T. and C. Hood	Valve for hot water apparatus	3
23.	209 to 224	S. F. Scott and Co.	Stained paper	1
24.	225	J. G. H. Ronketti	Hydrometer, &c.	3
24.	226	R. Harris	A glass	1
27.	227	W. B. Maplebeck and J. Lowe	A snuffer tray	3
27.	228 to 232	Hennell and Crosby	Stained paper	1
27.	233 to 237	Williams, Coopers, Boyle, and Co.	Ditto	1
27.	238	S. King	Letter balance	3
27.	239.	W. Thorold	Framework for a steam-engine	3
29.	240 to 241	S. F. Scott and Co.	Stained paper	1

* By the Designs Copyright Act, 2 Vic. c. 17, a copyright or property in every registered design or pattern is given to the author or proprietor thereof, for a term, in some instances, of twelve months, and in others, of three years. The act extends to all designs for articles of manufacture (except such as are provided for under the calico printers' acts,—27 Geo. 3, c. 38.—29 Geo. 3, c. 19.—34 Geo. 3, c. 23.—2 Vic. c. 13, and also lace,) if such designs are made for any of the following purposes, that is to say:—

1. For the pattern or print to be either worked into or worked on, or printed on, or painted on, any article of manufacture being a tissue or textile fabric:

2. Or for the modelling, or the casting, or the embossment, or the chasing, or the engraving, or for any other kind of impression or ornament, on any article of manufacture:

3. Or for the shape, or configuration of any article of manufacture.

Any article of manufacture being of *any metal* or *mixed metals*, is protected by registration for a term of three years.

The rights conferred by this act upon the authors or proprietors of original designs are subject to the following conditions:—

1. The design must be registered.

2. After the registration of the design, every article of manufacture published by the proprietor, *on which the design is used*, must have thereon the *name of the first registered proprietor*, the number *of the design in the register*, and the date of *registration*.

three conditions being observed, the right of the proprietor is protected from piracy by a penalty of from £5 to £30, upon any infringer, which may be recovered by the aggrieved party either by action in the superior courts, or by summary proceeding before a magistrate.

It should be understood that the privilege given by the act is not confined to the authors of designs only; for if the design be executed by the author on behalf of another person for a valuable consideration, the latter is entitled to be registered as the proprietor thereof; and any person purchasing, for a valuable consideration, either the exclusive, or the partial right to use the design, is in the same way equally entitled to be registered.

The fees payable at the Registration Office upon making the entry of a design are not regulated by the act, but the Board of Trade under its authority have fixed the following rates:—Three guineas for the registration of an article of metal for three years, and one guinea for any other articles for one year. Drawings and other documents required in the matter will make the average cost of a design in metal, about five guineas, and of other articles between two and three guineas. The editor of the *Mechanics' Magazine* (Mr. Robertson) will be happy to undertake the registration of designs for any of his readers or correspondents, and to give them every information upon the subject, either by letter, post paid, or personally at his office in London. Mr. Prosser, (of No. 2, Cherry-street, Birmingham,) Mr. R.'s agent for the manufacturing districts, will also transact business upon the subject with those to whom the locality of his residence may be more convenient. Address, "Patent and Design Registration Office, 166, Fleet-street, London."

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 24th OF DECEMBER, 1839, AND THE 28th OF JANUARY, 1840.

John Leo Nicolas, of Clifton, Bristol, gent., for certain improvements in the method of constructing and propelling carriages on railways and common roads, and through fields for agricultural purposes. Patent dated Jan. 1: six months to specify.

Samuel Lawson, of Leeds, and John Lawson, of the same place, engineers and copartners, for improvements in machinery for spinning, doubling, and twisting flax, wool, silk, and other fibrous substances. (A communication.) Jan. 2; six months.

Charles Greenway, of Douglas, in the Isle of Man, Esq., for certain improvements in reducing friction in wheels of carriages, which improvements are also applicable to bearings, and journals of machinery. Jan. 3; six months.

John Francois Victor Fabien, of King William-street, London, gent., for improvements in pumps. Jan. 7; six months.

David Low, of Adam's Court, Old Broad-street, merchant, for improvements in machinery, for crushing, preparing, and combing flax, hemp, phormium tenax, and other fibrous substances. (A communication.) Jan. 7; six months.

Moses Poole, of Lincoln's Inn, gent., for improvements in obtaining power. (A communication.) Jan. 7; six months.

John Ridgway, of Cauldon Place, Stafford, china manufacturer, for an improvement in the moulds used in the manufacture of earthenware, porcelain, and other similar substances, whereby such moulds are rendered more durable. Jan. 11; six months.

John Ridgway, of Cauldon Place, Stafford, china manufacturer, and George Wall the younger, of the same place, gent., for certain improvements in the manufacture of china and earthenware, and in the apparatus or machinery applicable thereto. Jan. 11; six months.

John Ridgway, of Cauldon Place, Stafford, china manufacturer, and George Wall, the younger, of the same place, gent., for certain improvements in the mode of preparing bats of earthenware and porcelain clays, and of forming or shaping them into articles of earthenware and porcelain, and in the machinery, or apparatus applicable thereto. Jan. 11; six months.

Christopher Edward Dampier, of Ware, attorney at law, for an improved weighing machine. Jan. 14; four months.

Hezekiah Marshall, of Canterbury, architect, for improvements in window sashes and frames, and in the fastening of window sashes, Jan. 14; six months.

Arthur Eldreld Walker, of Melton-steeet, Euston Square, engineer, for improvements in engraving by machinery. Jan. 18; six months.

Charles Wheatstone, of Conduit-street, Hanover Square, Esq., and William Fothergill Cooke, of Sussex Cottage, Slough, Esq., for improvements in giving signals, and sounding alarms at distant places, by means of electric currents. Jan. 21; six months.

Samuel Brown, of Finsbury Pavement, C. E., for improvements in making casks, and other vessels of, or from iron and other metals. Jan. 21; six months.

Joseph Rock Cooper, of Birmingham, gun-maker, for improvements in fire arms, and in the balls to be used therewith. Jan. 21; six months.

William Stone, of Wimsley, gentleman, for improvements in the manufacture of wine. Jan. 21; six months.

James Hall, of Glasgow, upholsterer, for improvements in beds, mattrasses, and apparatus applicable to bedsteads, couches, and chairs. Jan. 21; six months.

Arthur Howe Holdsworth, of Brookhill, Devon, esq., for improvements in preserving wood from decay. Jan. 21; six *months.*

William Coltman, of Leicester, framesmith, and Joseph Wale, of the same place, framesmith, for improvements in machinery employed in making frame work knitting or stocking fabrics. Jan. 21; six months.

Samuel Wilkes, of Darleston, iron founder, for improvements in the manufacture of hinges. Jan. 21; six months.

George Wilson, of St. Martin's-court, St. Martin's-lane, for an improved paper cutting machine. Jan. 21; six months.

Charles Rowley, of Birmingham, stamper and piercer, and Benjamin Wakefield, of Bordesley, machinist, for improved methods of cutting out, stamping, or forming and piercing buttons, shells, and backs for buttons, washers, or other articles from metal plate, with improved machinery and tools for those purposes. Jan 21; six months.

Edward Hallilley, of Leeds, cloth manufacturer, for improvements in machinery for raising pile on woollen and other fabrics. Jan. 21; six months,

William Hunt, of the Portugal hotel, Fleet-street, London, manufacturing chemist, for improvements in the manufacture of potash and soda, and their carbonates. Jan. 21; six months.

Miles Berry, of Chancery-lane, for certain improvements in the manufacture of prussiate of potash and prussiate of soda. (A communication.) Jan. 21; six months.

Jules Alphonse Simon de Gournay, of Bread-street, London, gentleman, for improvements in the manufacture of horse shoes. (A communication.) Jan. 22; six months.

George Clarke, of Manchester, manufacturer, for certain improvements in the construction of looms for weaving. Jan. 23; six months.

Alexander Helt, of Gower-street, Bedford-square, surgeon, for certain improvements in the arrangement and construction of fire grates or fire places, applicable to various purposes. Jan. 23; six months.

James Bingham, of Sheffield, manufacturer, and John Amory Boden, of the same place, manufacturer, for certain improved compositions which are made to resemble ivory, bone, horn, mother of pearl, and other substances applicable to the manufacture of handles of knives, forks, and razors, piano forte keys, snuff boxes, and various other articles. Jan. 25; six months.

Robert Montgomery, of Johnstone, Renfrew, gentleman, for an improvement or improvements in spinning machinery, applicable to mules, jennies, slubbers, and other similar mechanism. Jan. 25; six months.

Thomas Aitken, of Chadderton, Lancaster, manufacturer, for certain improvements in the machinery or apparatus for drawing cotton and other fibrous substances. Jan. 28; six months.

James Smith, jun., and Francis Smith, of Spital works, near Chesterfield, lace manufacturers, for certain improvements in machinery for the manufacture of figured bobbin net or lace. Jan. 28; six months.

William Pontifex, of Shoe-lane, London, coppersmith, for an improvement in treating fluids containing colouring matter, to obtain the colouring matter therefrom. Jan. 28; six months.

Henry Curzon, of Kidderminster, machinist, for certain improvements in steam-engines. Jan. 28; six months.

John Whitehouse, of West Bromwich, Stafford, iron master, for improvements in preparing and rolling iron and other metals or metallic alloys for the manufacture of certain articles of commerce. Jan. 28; six months.

William Mattershaw Forman, of Sheepshead, Leicester, framesmith, for certain improvements in stocking frames and machinery used in framework knitting. Jan. 28; six months.

William Cubitt, of Gray's Inn-road, Middlesex, builder, for certain improvements in roofing. Jan. 31; six months.

LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 22nd OF DECEMBER, 1839, AND THE 22nd OF JANUARY, 1840.

James Hay, of Belton, in Haddington, Scotland, captain in the royal navy, for an improved plough, "the Belton plough." Sealed December 23, 1839; four months to specify.

Christopher Nickels, of the York-road, Lambeth, Surrey, gentleman (a communication), for improvements in propelling carriages. December 24.

Joseph Gibbs, of Kennington, Surrey, engineer, for an improvement or improvements in the machinery for preparing fibrous substances for spinning, and in the mode of spinning certain fibrous substances. December 24.

Thomas Edmondson, of Manchester, Lancaster, clerk, for certain improvements in printing presses. December 31.

James Nasmyth, of Paticroft, near Manchester, engineer, for certain improvements applicable to railway carriages. December 31.

Thomas Laurente Lamy Godard, of Christopher's-street, Finsbury-square, London, merchant, (a communication from a certain foreigner), for improvements in looms for weaving, to be worked by steam or other power. January 8, 1840.

John Bradford Furnival, of Street Ashton, Warwick, farmer, (a communication from a foreigner), for improvements in apparatus or materials to prevent persons and quadrupeds sinking when in the water. January 8.

George Wilton Turner, late of Park-village, Regent's-park, Middlesex, but now of Newcastle-upon-Tyne, Doctor of Philosophy, and Herbert Minton, of Longfield Cottage, Stoke-upon-Trent, Stafford, manufacturer, for an improved porcelain. January 9.

Richard Beard, of Egremont-place, New Road, Middlesex, gentleman (a communication from a certain foreigner), for improvements in printing calicoes and other fabrics. January 9.

Alexander Francis Campbell, of Great Plumpstead, Norfolk, Esq., and Charles White, of Norwich, mechanic, for improvements in ploughs, parts of which improvements are applicable to harrows and other agricultural implements. January 9.

Robert Montgomery, of Johnston, Renfrew, Scotland, gentleman, for an improvement or improvements in spinning machinery, applicable to mules, jennies, slubbers, and other similar mechanism. January 9.

William Vickers, of Firs-hill, York, steel manufacturer, (a communication from a foreigner), for an improvement in the manufacture of cast steel. January 10.

Christopher Edward Dampier, of Ware, Hertford, attorney at law, for an improved weighing machine. January 14.

John Leslie, of Conduit-street, Hanover-square, Middlesex, tailor, (a communication), for improvements in measuring the human figure. January 15.

William Harper, of Cowper's court, Cornhill, London, patent stove manufacturer, and Thomas Walker, of Birmingham, Warwick, for improvements in stoves and grates, and in preparing metal plates for such stoves, and for other purposes. January 15.

Matthew Heath, of Furnival's Inn, London, gentleman, (a communication from a certain foreigner), for improvements in clarifying and filtering water, beer, wine, and other liquids. January 15.

Thomas Clark and Charles Clark, of Wolverhampton, Stafford, iron founders and co-partners, for improvements in glazing and enamelling cast iron hollow ware. January 15.

John Ainslie, farmer, Redheugh, near Dalkeith, for a machine for a new and improved mode of making or moulding tiles, bricks, retorts, and such like work from clay. January 20.

Samuel White White, of Charlton Marshall, Dorset, Esq., for improvements in preventing persons from being drowned. January 20.

Arthur Eldred Walker, of Melton-street, Euston-square, engraver, for improvements in engraving by machinery. January 20.

LIST OF IRISH PATENTS GRANTED IN DECEMBER, 1839.

P. A. Ducote for certain improvements in printing china, porcelain, earthenware, and other wares, and for printing on paper, calicoes, silks, woollens, oilcloths, leather, and other fabrics, and for an improved material to be used in printing.

A. F. Campbell and C. White for certain improvements in ploughs, harrows, scarifiers, cultivators, and horse hoes.

W. H. Hornley and W. Kenworthy for certain improvements in the machinery or apparatus for sizing or otherwise preparing cotton, woollen, flax, or other warp for wearing.

J. A. Tulk for certain improvements in the manufacture of iron.

J. T. L. Goodard for improvements in looms for weaving to be worked by steam or other power.

Joseph Gibbs for an improvement or improvements in machinery for preparing fibrous substances for spinning, and in the mode of spinning certain fibrous substances.

NOTES AND NOTICES.

Dodd's Patent Sawing Apparatus.—We have this week been favoured with the sight of a model of the ingenious machinery invented by Mr. Isaac Dodd, of Rotherham, for sawing wood in various curved forms, which have not hitherto been accomplished by machinery. A model of the curve intended to be cut, being fixed to a table, moving universally (to use a mechanical phrase,) the saws have a direction given to them parallel with the model: and whatever curve may be required, it is cut as exactly and as quickly as a straight line of the same length. The principle of the machine is similar to that of the pentagraph. There are a variety of departments of manufacture in which great saving will be effected by this machinery. We are glad to learn that the scientific inventor has kindly engaged to furnish a variety of models and engravings of machinery, invented or improved by myself, to the exhibition of the Sheffield Mechanics' Institute.—*Sheffield Independent.*

Occasional Steam Power.—The *Maria*, of 460 tons, a vessel belonging to Messrs. Gardner, Wynhast, and Co., has recently made use of ten-horse engines, in a voyage from London to Bombay. The engines put on board for occasional aid, during calms or light winds, were applied to Melvill's patent propeliers. Though the vessel with her cargo drew 16 feet 6 inches of water, it was propelled at the rate of three miles an hour, showing a great improvement in navigation. An extract from the log states that steam was used 511 hours, on 45 occasions, or 21 days and 7 hours. There can be no doubt that this use of steam may be greatly improved; the experiment thus made was proved of great aid in quickening the voyage, and is highly satisfactory.

Agricultural Machinery.—The Earl of Kingston is about to establish an agricultural model school at Michelstown to take apprentices, and have them bred up as working farmers.—*Times.*

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine *Office, No. 166, Fleet-street.*—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

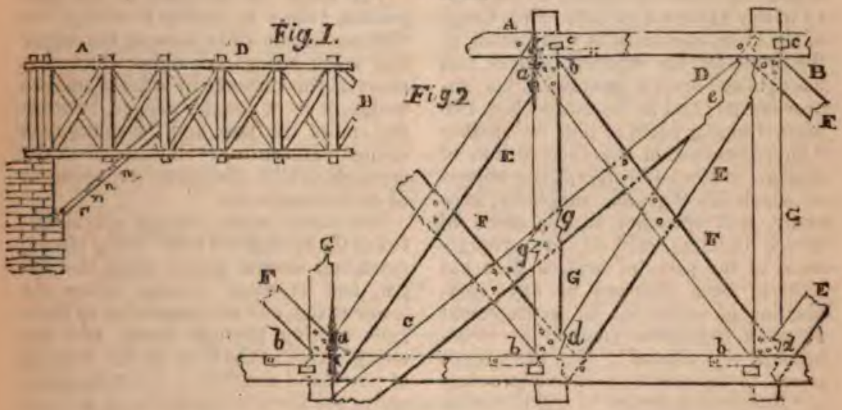
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 861.] SATURDAY, FEBRUARY 8, 1840. [Price 3*d*.

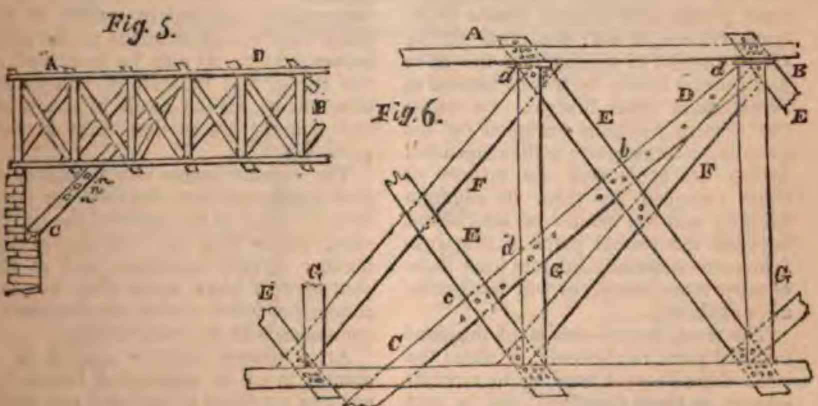
Printed and Published for the Proprietor, by W. A. Robertson, No. 166, Fleet-street.

COLONEL LONG'S SUSPENSION AND BRACE BRIDGES.

(Brace Bridge.)



(Suspension Bridge.)



COL. LONG'S SUSPENSION AND BRACE BRIDGES.

The nature of their country has led our American brethren to pay particular attention to the construction of wooden bridges of great span. A full account of a very remarkable structure of this kind, the great viaduct by which the Columbia and Philadelphia railroad crosses the river Schuylkill, we published in our xxist vol. p. 433. Col. Long, of the U. S. engineers, is well known in the States for his wooden bridges, and has obtained several patents for his improvements; and in November last, two patents were granted to him for further "improvements in the construction of wooden or frame bridges," the objects of which are "greater simplicity, economy, and efficiency in the mode of bridge building, and in the arrangement of the parts of bridges than has hitherto been obtained by any combination of principles, or arrangement of parts heretofore adopted in structures of this nature". The one patent relates to the new mode of constructing a "Suspension Bridge"—and the other to a "Brace Bridge." The following are the descriptive parts of the Colonel's specifications, which we extract from the *Franklin Journal*:—

The Suspension Bridge.

The suspension bridge is composed of two or more truss frames, together with arch braces, lateral braces, flooring, &c., and is distinguished from other bridges heretofore invented, and now in use, by reason of the following actions in the posts, main braces, and counter braces of its truss frames, *to wit:* the posts act by *thrust* instead of *tension*, and the main and counter braces by *tension* instead of *thrust*, as in other bridges. Of course the relative positions occupied by the main and counter braces in the suspension bridge, are completely the reverse of those occupied by them in common bridges, and the modes of attachment between the several parts of the truss frame, are materially different from those of other truss frames, as will be hereinafter explained.

The truss frames consist of the same nominal parts respectively, of about the same dimensions according to circumstances, as those described, and in part claimed as new, in my specification of a *patent for a wooden, or frame bridge, for which I make application for a patent* simultaneously with this application for a brace bridge (p. 326): excepting that the posts may be narrower and shorter, and the main braces about two feet longer than those applicable in conformity to the specification just referred to; said braces passing through, and protruding five or six inches beyond the strings both above and below.

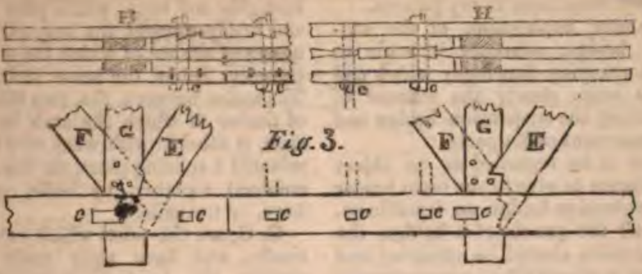
The length of the posts of the suspension bridge is such as to occupy the distance in the clear between the upper and lower strings; or rather somewhat short of this distance in order to admit a wedge, or set of counter wedges, between one end of the post and the contiguous string. The posts are all flush, or in the same plane with the outer string-pieces of each truss frame.

The main braces occupy spaces between the central and outer string pieces, extending several inches above the upper, and an equal distance below the lower string, and are suspended by three nails passing through them, and the string-pieces at the head of the first set of posts, and attached in a similar manner to the lower string-pieces at the foot of the second set of posts. This mode of suspension and attachment is carried on through the half bridge span, beginning at the abutment or pier, and ending at the centre of the span. At the centre of the span, the main braces are halved or locked together, and treenailed as before between the string-pieces. The spaces for the main braces between the central and side string-pieces of the upper string, at the centre of the span, being unoccupied, may receive timbers of the same transverse dimensions as the main braces, which may also be treenailed to the string, and thus afford substantial attachments for the heads of the posts and counter braces that meet at that point.

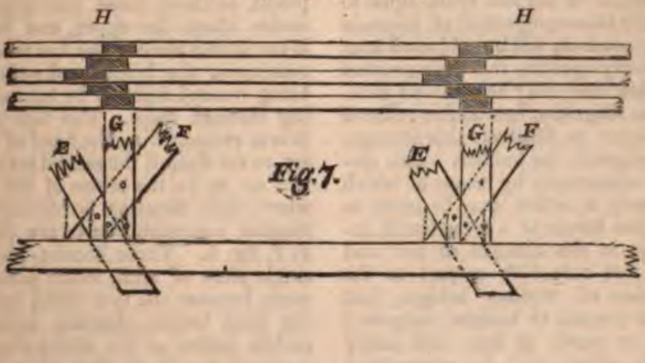
The counter braces are treenailed at their heads and feet, between the main braces, except at the centre of the bridge span, where they are attached in the manner already explained, and at the abutment or piers where they are accommodated with similar attachments in connexion with the lower strings.

Arch braces may be applied in a manner to act as suspension braces, by erecting a gallows at each pier and abutment of sufficient height and strength for this purpose; but the most appropriate mode of applying these parts is

Parts of Brace Bridge.



Parts of Suspension Bridge.



that adopted in connexion with the plan heretofore recognized in my patents.

In further explanation of the suspension bridge, reference is made to the accompanying drawings; which will illustrate more clearly the manner of constructing the suspension bridge and the arrangement of its parts.

Should it be regarded as an object of importance to give to the main braces of the suspension bridge an equable action in all the panels of a bridge, the following rules should be observed and the object in view will be approximately accomplished. Let the extent of the bridge span, between the abutment or pier supports, be 120 feet, and the height of the truss frame, or rather the distance from centre to centre of the strings, be fifteen feet. Now, commencing at either extremity of the span, the first panel should have a distance measured on the strings, from centre to centre of the posts, equal to 5¼ feet, the second panel, a distance of 6¼ feet, the third equal to 7¾ feet, the fourth, 9¾ feet, the fifth 13 ft., and the sixth 18 feet, making the aggregate extent of the half span, equal to 60 feet. By this arrangement all the main braces respectively will be subjected to an action nearly equable, and their greatest possible efficiency may be rendered available. The diagrams, hereinafter referred to, will serve to illustrate this arrangement, and guide the builder. This method of adjustment, by means of which a uniformity of action may be given to all the main braces of a truss-frame, respectively, is also claimed as new and original, not only with respect to the construction of wooden bridges, but also with respect to bridges composed of iron, or partly of iron and partly of wood; which may be constructed of similar parts nominally, though these parts may all differ in shape, dimensions, and manner of attachment to each other, all of which may be varied according to circumstances.

In the accompanying drawings, fig. 5, (see front page) A, B, C, D exhibits a side view of a portion of a truss frame of my suspension bridge, attached to its abutment; and fig. 6, shows a similar side view of a part of the truss frame, on an enlarged scale, for the purposes of exhibiting its construction the more clearly. *C, D, is the arch brace,* which bears *upon the abutment* as shown at C, fig. 1; *n, n, n,* in the same figure, represent gibs and keys, which pass through and firmly connect the respective thicknesses of timber, of which the arch brace connects below the lower string piece. The space between the two thicknesses of timber of which the arch brace consists, is filled in with what may be denominated a splicing piece, the whole being confined together by bolts, gibs and keys, or treenails.

G, G, are the posts which extend vertically, and have their ends bearing against the lower and upper string-pieces, against which they abut. At *d, d,* between the upper ends of these posts and the upper string-pieces, there are counter wedges, which when driven in, necessarily cause these posts to act upon the string-pieces by direct thrust, which causes the main and counter braces to act by tension instead of thrust.

The string-pieces consist each of three thicknesses of stuff, as shown in the top view H, fig. 7, and the main suspensor braces E, E, fig. 6, occupy the spaces between the central and outer string-pieces, as above stated, and extend seve- inches above the upper, and below the lower string-pieces; the five thicknesses composing the braces and string-pieces being secured together by treenails passing through them. The first of these braces extends from the head of the first set, to the floor of the second set of posts, and so on to the centre of the bridge, where their direction is reversed. The counter extension braces are shown at F, F, fig. 6. These consist each of a single piece of stuff, which passes obliquely between the two which constitute the main braces, abutting against the middle timber of the string-pieces, and confined at each of their ends between the main braces and posts, by means of treenails, or other analogous devices.

Fig. 7 exhibits a horizontal and vertical section of a portion of one of the strings, and shows the manner of connecting the posts, main, and counter braces with the strings. The shades in the upper part H, of this figure, indicate sections of the posts, main, and counter braces at the upper edge of the lower string, and by inversion, at the lower edge of the upper string. E, F, and G, designate the same parts as in fig. 2.

In fig. 10, (p. 325) A, B, C, D, is a vertical diagram, intended to exhibit the relative

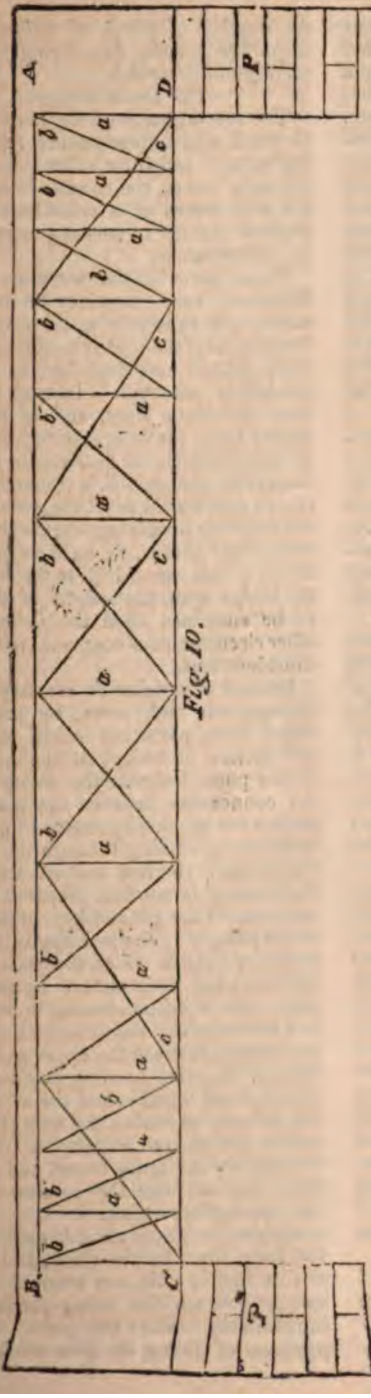


Fig. 10.

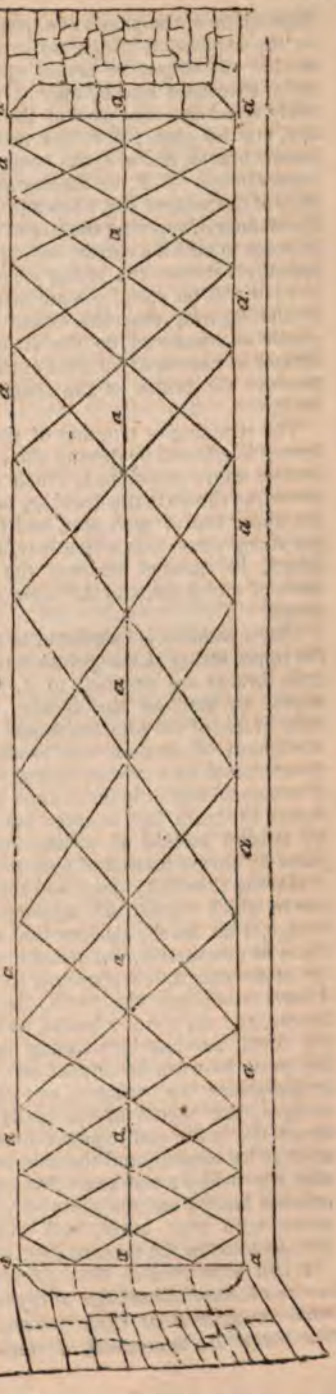


Fig. 11.

dimensions of the panels of a truss frame for my suspension bridge, so graduated as that the stress, or action upon the main suspensor braces, may be respectively equal in every part of the frame. *a, a*, are the posts; *b, b*, the main suspensor braces, and *c, c*, the counter suspensor braces. P, P, are the abutments or piers of the bridge. Fig. 11 (p. 325), shows the manner of applying the lateral braces, in order to afford a corresponding action laterally between the string pieces *a, a, a, a*; it will be seen from an inspection of the figures, that the extent of the panels as measured on the strings, increases as measured from the extremities towards the centre of the span of the bridge.

The straining or trussing of the truss frames is effected by driving the counter wedges above mentioned, which are situated, as shown in the drawing, between the upper end of each post, and the upper string piece, but which may, if preferred, be situated between the lower ends of said posts, and the lower string-pieces.

This operation is calculated to elevate the upper string at the points where the main braces are attached to it, and of course to increase the tension of the main braces of the adjacent panel. Every movement of tension thus produced is counteracted by a corresponding degree of antagonal tension in the counter braces, thence the main and counter braces act by tension instead of thrust, and the posts by thrust instead of tension.

Having thus fully described the manner in which I construct my suspension bridge, I do hereby declare that what I claim as new therein, and desire to secure by letters patent, is the manner in which I have combined the posts, the main braces, and the counter braces, as herein set forth, so that by wedging up the the posts between the upper and lower string-pieces by wedges, or counter wedges, the thrust of the posts shall cause the main and counter braces to operate by tension, and thereby to sustain the bridge; the main braces, the counter braces, and the posts being connected with each other, and with the string-pieces in the manner described.

I will here remark that although I have mentioned the strings of my bridge as each composed of three pieces, this number may be increased, if desired; the number of pieces of timber in the respective braces, &c., being made to correspond therewith.

The Brace Bridge.

The several parts of the brace bridge to which said improvements relate, are the strings and their splices, the posts, the main braces, the counter braces, and the arch braces of a truss-frame; and also the manner of trussing or straining the truss-frames.

These parts in the structure herein described, vary materially in their relative, and especially in the transverse, dimensions of the timber used from those contemplated and described in bridges previously patented. Instead of timbers of various sizes, and of nearly a square form, the several parts alluded to are to be uniform, or nearly so in all their transverse dimensions, a transverse section of each timber of all the parts having the form of a parallelogram, varying from two to four inches, by eight to twelve or fifteen inches, according to the length of the bridge span, the weight of the load to be sustained upon the bridge, and other circumstances connected with these considerations.

Instead of notches or recesses in the string-pieces and posts, by means of which these parts are locked together, and instead of wedges at the insertions of the posts between the string-pieces, the connexions between the posts and strings are effected by means of gibs and keys passing entirely through the strings transversely thereof, and at the same time resting in notches, prepared for the reception of the gib and key, in the back of the post, or in the side opposite to the points or steps at which the main braces communicate their thrust against the posts; the notches serving to regulate and maintain the relations with respect to distance, between the upper and lower strings, the gibs serving to clamp the string-pieces together and the keys serving not only to confine the strings to the posts; but also, to impart the requisite trussing to the truss frame, and at the same time to force the counter braces into appropriate action.

Joggles, or pieces of timber about two feet long, three inches thick, and three or four inches wide, are inserted in the spaces between the string pieces, and immediately behind the posts, for the purpose of aiding the gibs and keys in

counteracting the thrust of the main braces. The joggles are applied subsequently to the adjustments effected by trussing, being confined at one end by appropriate notches in the posts for their reception, and at the other by treenails passing through them and the string-pieces.

The main braces are connected to the posts by means of notches or steps in the latter, adapted to the reception of tuscums at the ends of the former.

Instead of tuscums and steps as described in the preceding paragraph, steps of cast iron, with appropriate lugs or braces on opposite sides of each step, adapted to suitable receptacles for the same in the posts and braces, as represented in the accompanying engravings, may be substituted for the purpose of receiving and resisting the action to which these parts are subjected.

The counter braces occupy the entire distance between the upper and lower strings diagonally of each panel of the truss frame, and are confined between the posts by treenails passing through them and the posts near the strings. They may also be confined to the main braces by treenails passing through them at the intersections of the former with the latter. The counter braces are brought into their appropriate action by straining upon the gibs and keys of the strings, in the manner before explained.

The arch braces rise in three or more pieces from a bench or bolster attached to the abutment or pier below the bridge, pass through the lower string in two or more pieces within the openings or interstices occasioned by the posts and main braces; enter the first, second, or third panel of the truss frame, counting from each end of the bridge span, and thrust against the furthermost posts of the panel entered; being intercepted by these posts, against which the thrust of the arch braces is communicated in part by means of appropriate notches in the former, and corresponding tuscums in the latter. The action of the arch brace is continued past the posts by similar pieces and connections within the next panel, and by the aid of a splicing piece situated between the posts and extending from the counter brace of the panel first entered to that of the panel beyond, and occupying the space between the side pieces of the arch brace. Thus continued, the arch brace extends to the head of the next main braces, and is connected with them near the upper string by means of corresponding tuscums and notches. In order to render the action of the arch brace more certain and efficient, another splicing piece is inserted, extending from the counter brace last-mentioned to the head of the next counter brace, and occupying as before the space between the cheeks or side pieces of the arch brace. The several parts of the arch brace situated within the truss frame, as also the posts and main braces at the crossings or intersections of the arch braces, are firmly united by treenails passing entirely through the several pieces of which they are composed.

The interior portions of the arch braces situated beneath the truss frames are respectively furnished with a series of gibs snd keys, which serve not only to confine together the pieces of which they are composed, but also to render the arch braces extensible, or the reverse, as may be found necessary, either to give appropriate action to the arch brace, or to increase or diminish the camber of the bridge.

The splicings of the outside string pieces are effected by means of wooden splicing pieces with appropriate notches, and corresponding tuscums, or with joggles of iron or wood, situated in appropriate notches prepared for their reception in the splicing piece and string piece, and may be clamped together by gibs and keys, or by screw bolts passing entirely through the strings. The central string piece may also be spliced in a similar manner, or by means of treenails of wood passing entirely through the strings, no other clampings being required in this case.

The lateral bracing is effected by means of locked lattice work, banded by ribbands on both sides of each truss frame of the bridge, both above and below the lateral braces. The ribbands are confined to the lateral braces by treenails passing entirely through them and the braces, at every intersection of the former with the latter.

The accompanying engravings will serve to illustrate and make known the manner in which I construct the respective parts of my brace bridge, and carry my improvements into operation.

In fig. 1 (front page) A, B, C, D, represents a side view of part of a truss frame; C, D, being the arch brace with its lower end, C, resting on a bench, or bolster on the abutment or pier below the bridge; *n*, *n*, *n*, showing the situation of the jibs and keys, by which the respective thicknesses of timber of which the arch pier consists are, confined together.

In fig. 2 (front page) A, B, C, D, is an enlarged view of a part of such a frame, drawn to a scale sufficiently large to exhibit the mode of connecting the respective parts thereof, C, D, is the arch brace, E, E, are the main braces, F, F, the counter braces, and G, G, the posts. The timbers constituting the arch brace are connected at *g g* with the posts G, by means of tuscums and notches, and with one of the main braces E, by similar means, as shown at *e*. The main braces, E, E, are likewise connected with the posts, G, G, both above and below, by like means. The posts G, G, extend a few inches above the upper and below the lower strings. These strings consist each of three thicknesses of stuff, as shown at H, fig. 3. The posts G, G, and the main braces, E, E, are each of them double, and their ends are received into the spaces between the centre and the two outer string pieces. The counter braces, F, F, are single, and abut against the centre string pieces both above and below. They are treenailed at each end to the posts G, G, and also to the main braces where they pass between them.

The space between the two piers of timber which constitute the arch brace C, D, I usually fill up by inserting what I denominate splicing timber, and connect the whole together by passing treenails through them.

It has been mentioned above, that *n*, *n*, *n*, in fig 1, show the situation of the gibs and keys, by which the respective timbers composing the arch beam are connected together; such jibs and keys are also employed for the same purpose in various other parts of the structure. Thus, for example, they are employed in the mortises through the timbers shown at *c*, *c*, *c*, *c*, fig. 2. The manner of constructing these gibs and keys, and of inserting and fixing them so as to confine the timbers together, will be manifest upon reference to fig. 9, (p. 323) where they are represented on an enlarged scale. They are also shown as passing through the string pieces in fig. 1, and through the arch braces in fig. 2. Between the string pieces, and immediately behind, and in contact with the posts, I insert joggles, or blocks of timber represented by *b*, *b*, *b*, fig. 2, which I fasten in place by treenails. These are for the purpose of sustaining the posts, and preventing their yielding or splitting at the gib notches. The mortices *c*, *c*, *c*, shown on the upper and lower string pieces in fig. 2, intersect the posts in those parts, and the posts are necessarily notched out to allow the gibs and keys to pass on their sides opposite to the main braces. These notches in the posts serve, as above remarked, to maintain the relative distance between the upper and lower string-pieces; to clamp and confine them together, and to impart the requisite power of trussing to the truss frame.

Fig. 3 exhibits different views of a portion of the string-pieces, showing the manner of splicing them, and also the relative positions of the string-pieces, posts, and braces, as theyp roject into, and are connected with, each other. These representations apply equally to the upper and lower portions of the truss frame.

Fig. 4 represents a portion of the arch brace, with the manner of applying the gibs and keys thereto, by which it may be extended or contracted at pleasure, the several mortises for the gibs and keys being at equal distances from each other. By this arrangement, the camber of the truss frames may be increased or diminished as may be required. The centre and the two outer pieces of the five thicknesses represented as clamped together in fig. 8, are those which rest upon the bench or bolster of the abutment or pier, the other two pieces are those which pass up into the truss frame.

Instead of the notches and tuscums formed in the timber for connecting the main braces and the posts, I sometimes employ steps or bearings of cast iron, which are furnished with lugs or tuscums, projecting out from each of their sides, and entering corresponding notches made in the posts and braces. These are shown in place at *a*, *a*, fig. 2, and separately on an enlarged scale at fig. 8; similar steps or pieces of cast iron may be employed for splicing and uniting the string pieces, being substituted for the intermediate notched splicing-pieces of wood represented as used at H, H, fig. 3.

Remarks by the Patentee on the Application and Use of the principles embraced in the foregoing Patents.

In the application of the principles contemplated in the preceding patents, and for the purpose of effecting approximately, and with convenience, an equality of action in the main braces of the truss frame, both in the common and suspension bridges, it is deemed advisable to vary the lengths of the panels as measured horizontally on the strings, in the following manner, viz: Let the exterior panel of each bridge span, or the panels nearest the abutments or piers, have respectively an extent of about five feeet. Let the panels next in succession, as we proceed from the extremities towards the centre of the span, have respectively an extent of about six feet. Let the third panel from each pier or abutment have an extent of about seven and a half feet; and the fourth, an extent of about nine and half feet; and let the residue of the panels have a uniform extent of about twelve feet, equal to, or somewhat less than, the distance in the clear between the upper and lower strings of the bridge.

Whenever treenails are inserted, care should be taken to place them in such positions, as will ensure their greatest possible efficiency without impairing the requisite strength and tenacity of the timbers through which they pass.

The treenails should be made of well seasoned, strong and durable timber, and may be formed by driving them through a circular cutter of tempered steel, and of such dimensions as may be deemed most suitable for the particular purposes for which they are intended. The size of the treenails should vary from 1¼ inch to 1¾ inch in diameter. The more numerous the treenails, the more efficient the structure, provided they are not so frequent as to impair the requisite efficiency of the other bridge timbers.

In the use of the improvements provided for in these patents, it should be borne in mind, that a truss frame may be composed of an indefinite number of string-pieces, posts, main and centre braces, as also of arch-brace timbers, all of which may be uniform in their transverse dimensions and of any size that may be deemed most appropriate, from *a thickness of one inch* and a width of six inches, to a thickness of four to six inches, and a width of 12 to 15 inches.

The most convenient method of adjusting the splices of the strings, will probably consist in the insertion of splicing pieces of timber between the string-pieces, through all of which gibs and keys, together with treenails (should the latter be deemed appropriate) may pass, confining the whole firmly together. The requisite tension in the strings at the splices, may be provided for by means of iron joggles, passing vertically in notches prepared in the splicing pieces and string-pieces for their reception. The transverse dimensions of the joggles should be about ¾ by 1½ inch, and their length equal to the width of the string-pieces. Of course, the notches for the reception of the joggles will be ¾ inch deep, and of an equal width; the notches in the splicing pieces, and in the string-pieces being respectively equal, and correspondent to one another.

In the mode of bridge building herein contemplated, there will be very little occasion for screw bolts or other iron work, yet in the confining of the lateral bracing to the truss frames, and in various other parts of the work, screw-bolts, key-bolts, spikes, &c., will greatly facilitate the structure, and may be employed to advantage.

Inasmuch as no gibs and keys are required at or near the centre posts of each span, screw-bolts, or key-bolts will be o service for the purpose of clamping together the strings at these points.

The transverse and stay braces may be applied in the same way as proposed in my former patents.

The adjustments of the arch braces should be such as to insure the greatest possible strength and efficiency. Special care should be taken to introduce the splicing pieces connected with these parts, in a manner to render their action uniformly efficient, quite from the bolster at their lower extremities, to their connexion with the upper strings.

It is obvious that the arrangements prescribed in reference to the suspension bridge, are not only applicable in wooden structures, but, with slight alterations and appropriate modifications, the same principles are equally applicable in the construction of iron bridges. In this application of the principles, it would be

advisable to construct all the parts that are exposed to *tension*, of wrought iron, while those exposed to *thrust*, or compression, may be constructed either of wood or of cast iron. The connexion between the strings, main and counter braces, may be effected by means of key-bolts of suitable size, passing entirely through these parts, and confining them together, the main and counter braces being merely rods or bars of wrought iron with eyes at their extremities, adapted to the reception of the bolts.

It should be further observed in reference to the suspension bridge, that the heads of the posts should not be confined to the braces till the keys shall have been driven, and the truss frames subjected to their appropriate strain, after which tree-nails or spikes, at the discretion of the architect, may be inserted through the heads of the posts and braces, and wherever else they may be deemed useful.

STEPHEN H. LONG.

P. S. It will be advisable to adopt the following rule for the adjustment of the panels of a bridge span; for example, let the panels situated between any abutment or pier, and the heads of the arch braces, have respectively an extent measured on the strings, about equal to two thirds of the height of the truss frames from centre to centre of the strings, and let the other panels of the span be adjusted in conformity to the directions prescribed in a former part of this essay.

S. H. L.

EXPERIMENTS TO ASCERTAIN THE DEPTH OF THE SEA BY THE ECHO.

Sir,—I have been much gratified, and so must have been many of your readers, with the very interesting account of Professor Bonnycastle's experiments for the purpose of ascertaining the depth of the sea by means of the echo, or reflection of sound.

Any suggestions that afford new subjects of inquiry, new trains of thought, or new materials for philosophical analysis, must always be of the highest interest to the scientific enquirer.

That the Professor should have failed in the precise object of his pursuit, cannot excite surprise, (although the idea is excellent) as the circumstances under which sound is propagated in air and water are widely different.

In producing a reflected sound or echo at or near the earth's surface, the vibrations or undulations take place through a medium of almost uniform density, whilst a sound descending through water, passes through an ever-varying medium, and will soon be spent by passing off laterally in accordance with that established natural law which compels all free motion to take *the line of least resistance*. That sound can be conveyed a long distance by means of water, in a direction *parallel to the natural horizon*, is a fact too well known to require comment; but it becomes a matter of no ordinary difficulty to cause it to travel through a medium of increasing density.

A writer in the *Encyclopedia Metropolitana* remarks, that, "It is highly probable that waves of sound, like waves of light, in passing from a rarer to a denser medium, undergo a total dispersion," as the brightest sunbeam that ever shot its rays into the bosom of the ocean is unable to illuminate "The dark coral caves of the deep blue sea."

Auderon, in the *Philosophical Transactions* for the year 1748, page 151, says, "he made three persons strip quite naked, dive at once, and remain about two feet below the surface of the water, in this situation he spoke to them as loud as he was able; at their coming up they repeated his words, but said he spoke very low; he caused the same persons to dive to twelve feet below the surface and discharged a gun over them, which they said they heard, but that the report was scarcely perceptible; he further caused a diver to halloo! under water, which he did, and the sound was heard but faintly. A grenade exploded about nine feet below the surface gave a prodigious hollow sound, with a most violent concussion of the earth around.

The Abbe Nollet having descended to various depths from 4 to 24 inches, could hear all sounds in the air, as a hunter's horn, the human voice, &c., distinctly, but faint and attenuated.

In conclusion, I beg to remark that I do not bring forward this paper for the purpose of controversy, but for the purpose of drawing attention to the many valuable facts that may be picked up by those who have the patience and perseverance to trace the true causes of effects.

I am, Sir,

Yours, &c.,

WM. JONES.

Manchester, Jan. 27, 1840.

ATLANTIC STEAM NAVIGATION.— GREAT IRON STEAMER.

At the commencement of another season of Atlantic steaming, it may be interesting to make a few observations upon the performances of the great competitors in the race, and to notice a new rival for public favour. In the *Shipping Gazette*, of the 22nd ult., we find the following comparison of the passages performed by the steamers, and sailing vessels, to and fro, from the departure of the *Great Western* on the 9th April, 1838, to the last return of the *Liverpool*, on the 11th of Dec., 1839.

"The Great Western made.. 11 voyages.
Royal William ...... 3 ditto.
Liverpool .... 6 ditto.
British Queen ...... 3 ditto.

"The average of the liners' passages from Liverpool to New York, is 33 days 42 minutes, whilst the average of the steamers during the same period (allowing an average passage of 18 days for the *Liverpool* in lieu of that in which she put back to Cork) is 17 days 18 hours. The average passage of the sailing liners from New York to Liverpool is 22 days 16 hours, while the average of the steam ships, including the two long passages of the *British Queen* and *Liverpool*, is 16 days 8 hours.

"The shortest passage from Liverpool to New York of the sailing liners is that of the *Roscius*, 19 days, in November and December last; the shortest passages of the steamers are those of the *Great Western*, 13 days and a few hours, on two occasions. Of the sailing liners, four appear to have been 22 days, and 75 range between 30 and 48 days. From New York to Liverpool, four passages of 16 days, two of 17, 14 of 18, and five of 19, appear to have been made by the sailing liners, the remaining 75 passages averaging between 20 and 36 days."

With regard to the steam ship which bears so prominent a part in the above statement, the *Great Western*, we know that she has been thoroughly examined, after her performance of eleven voyages, about 35,000 miles, and nearly twice as much as the *Liverpool*, and found in so perfect a state as greatly and pleasingly to surprise those who were engaged in the task, and to reflect great credit on all concerned in her construction.

The *Great Western Steam Company* have commenced building a large iron steamer. A dock has been excavated for the express purpose of her construction, and most excellent erecting shops fitted up for the engines, with foundry, cranes, and other conveniences. The vessel is to be 300 feet long, by about 45 wide, and 30 deep. Her keel plate is 1 in. iron, and the others of 5-8ths, with double rows of rivets. The ribs are of angle iron, rolled on purpose, and are placed at 18 inches apart. She will have a very beautiful bow. Her midship section is on the French principle laid down in 1790 by Romné.

The cylinders of the engines are to be of 110 inches diam. and 8 ft. 6 in. stroke —each engine of 500 horses power. The boilers are made in three parts.

The capabilities of iron steam vessels will, by this grand experiment, be fairly tested.

MC IVER'S ASTRONOMICAL QUESTION.

Sir,—When I wrote the solution of Iver Mc Iver's astronomical question, I was labouring under a severe attack of the lumbago. I now find I have made a mistake in the formula for finding the sun's declination which I stated to be "$\tan. D = \frac{\tan. L'}{\cos. (x + A)} = \frac{\tan. L}{\cos. (x - A)}$." This should have been,

$$\tan. D = \frac{\cos. (x + A)}{\tan. L} = \frac{\cos. (x - A)}{\tan. L'}.$$

Again, in the fifth line of the calculation, for "cos." read cot.; and for "cot. 9.469415" read, cos. 9.469698.

I am afraid Nautilus will find some difficulty in assigning the *exact* position of two places on the surface of the earth, at which the sun will *rise* and *set* simultaneously on the same day; your youthful and highly talented correspondent, Mr. John Nelson, has, in my opinion, given an excellent answer to it, so far as it is capable of solution; Nautilus, however, does not seem to be satisfied with it, he is, therefore, bound to give us a better solution (if he can). If Mr. Nelson pays the same attention to spherical trigonometry as he has evidently done to plane trigonometry, he will be a most valuable correspondent for your interesting magazine.

I am, Sir, yours, &c.,

GEORGE SCOTT.

January 21, 1840.

ASTRONOMICAL QUESTIONS AND SOLUTIONS.

Sir, — Mr. George Scott is peculiarly happy in making discoveries. At page 182, vol. 30, he discovered that when the periods, &c., of the planets are spoken

of, *mean* periods are generally understood; although in the discussion to which he was referring, the word "mean," had been repeated *ad nauseam*, and no person, except Mr. S., could possibly have imagined that any other than mean periods were thought of. In your last number he announces an equally notable discovery, viz., that in my answer to the question at page 139 of the present vol., I had not adopted the shortest possible method of calculation.

My object was, not to point out the shortest possible method of performing a calculation that can never become of any practical use, but to give a familiar explanation of the principle of the question. Whether the method I adopted was more suitable for that purpose than that discovered by Mr. Scott, I leave to your readers to decide. I am extremely unwilling to obtrude the drudgery of figures, which any one may perform for himself, upon your valuable pages; but when Mr. Scott has had the hardihood to assert, that the method used by me, (but which, after all, I merely alluded to in illustration) is *nearly double* of the one attempted by himself; you must, in common fairness, allow me to institute the following comparison between them. I say the method *attempted* by Mr. Scott, because, however he may have jumped into his answer at page 272, it was clearly not by the process there set down, which is loaded with blunders evidently *not* typographical.

Referring to page 182 for the explanation of the letters, the work is as follows:—

P	3	11	0 ..	secant ..	0.000671 ..	cotan ..	1.254793
P B	34	3	0 ..	cotan ..	0.170195		
ϕ	34	0	32 ..	cotan ..	0.170866 ..	cosect ..	0.252339
P A	38	31	0 ..	sine	9.794308		
θ	4	30	28 ..	.. .. ..	.. .. ..	sine....	8.895391
A	21	35	37 ..	sine	9.565875 ..	cotan ..	0.402523
Declinat.	13	14	56 ..	sine	9.360183		

Thus there are,	By this method	By Mr. Scott's
Lines of Logs	10	10 one suppressed
Lines of Angles................	7	9 one suppressed
Tabular searches	10	8
Arithmetical operations of Logs ..	3	4 one suppressed
Do. Do. Angles .	1	3
Total number of operations	31!	34!

But I might, in strictness, have set down to the account of the method here given, 7 instead of 10, "tabular searches," for three of them are merely different functions of the same angles, and may therefore be taken out at the same inspection.

NAUTILUS.

Leeds, January 20, 1840.

P. S. To save your correspondents any further trouble with the question proposed by me in illustration of my answer to Iver Mc Iver's question, I beg to subjoin the following explanation:—

Let there be two places of equal latitude, and nearly upon the same meridian, but in opposite hemispheres. For example, Greenwich, and a place having 51° 29′ south latitude, and 15′ west longitude. Let, also, *the sun's semidiurnal motion in declination, at the vernal equinox, be* 5′ 58″, and let the instant of the vernal equinox be $12^h\ 0^m\ 30^s$ Greenwich apparent time, and consequently $11^h\ 59^m\ 30^s$ apparent time at the southern place; the motion in declination, in 30 seconds, being inappreciable, it may be assumed that the equinox takes place at the instant of noon in both places. Therefore the declination, at Greenwich sun rise, will be 5′ 58″ south; and at sun set, 5′ 58″ north; and the evening semiday will exceed the morning semiday by one minute. But at the southern place the reverse will be the case, the morning semiday being the longer by the same quantity. Consequently, the instant of sunrise and sunset will appear one minute later by Greenwich clocks, than by those at the southern place; but there being one minute difference in their time, (or longitude) it follows that the occurrences are, in reality, simultaneous.

GAS MAKING STATISTICS.

For the following valuable statistical details upon gas-light, (says Dr. Ure in his *Dictionary of Arts and Manufactures*) my readers are indebted to Joseph Hedley, Esq., engineer, of the Alliance Gas Works, Dublin; a gentleman who to a sound knowledge of chemistry, joins such mechanical talent and indefatigable diligence, as qualify him to conduct with success, any great undertaking committed to his care. He has long endeavoured to induce the directors of the London gas-works to employ a better coal, and generate a more richly carburetted gas, which in much smaller quantity would give as brilliant a light, without heating the apartments unpleasantly, as their highly hydrogenated gas now does. Were his judicious views adopted, coal gas would soon supersede oil, and even wax candles, for illuminating private mansions.

Copy of a Paper laid before a Committee of the House of Commons, showing not only the relative values of the Gases produced at the undermentioned places, but showing in like manner the relative economy of Gas as produced at the different places, over Candles. By Joseph Hedley, Esq.

Names of the Places where Experiments were made.	Illuminating power of a single Jet of Gas-flame four inches high, taken by a comparison of Shadows.	The Jet of Gas burnt, four inches high, consumed per hour and was equal to the Candles in the last column.	Gas required to be equal to 100lbs. of Mould Candles, 6 to the lb., 9 inches long each.*	Selling price of Gas per meter per 1,000 cubic feet.	Cost of Gas equal in illuminating power to 100lbs. of Candles.†	Average discount allowed off the charge for Gas.	Net cost of Gas equal to 100 lbs. of Candles.	Specific gravity of the Gas.
	Equal to Candle s.	*Cubic feet.*	*Cubic feet.*	s. d.	£ s. d.	*Percent.*	£ s. d.	
Birmingham; Birmingham and Staffordshire; two Companies	2·572	1·22	2704	10 0	1 7 0	9	1 4 7	·541
Stockport	3·254	·85	1489	10 0	0 14 11	12½	0 13 0	·539
Manchester	3·060	·825	1536	8 0	0 12 3	11¼	0 10 10	·534
Liverpool Old Company‡	2·369	1·1	2646	10 0	1 6 5	6¼	1 4 9	·462
Liverpool New Gas Company	4·408	·9	1164	10 0	0 11 8	6¼	0 9 10	·580
Bradford	2·190	1·2	3123	9 0	1 8 1	12½	1 4 6	·420
Leeds	2·970	·855	1644	8 0	0 13 2	6¼	0 12 4	·530
Sheffield	2·434	1·04	2440	8 0	0 19 6	6¼	0 18 3	·466
Leicester	2·435	1·1	2575	7 6	0 19 3	15	0 16 5	·528
Nottingham	1·645	1·3	4200	9 0	1 17 9	15	1 11 3	·424
Derby	1·937	1·2	3521	10 0	1 15 4	15	1 10 0	·448
Preston	2·136	1·15	3069	10 0	1 10 8	15	1 6 2	·419
London	2·083	1·13	3092	10 0	1 10 11	none allowed.	1 10 11	·412

Memorandum.—It will not fail to be observed, that in deducing the comparative value between candles and gas by these experiments, the single jet (and in every instance of course it was the same), has been the medium. This, however, though decidedly the most correct way of making the comparative estimate of the illuminating power of the several gases, is highly disadvantageous in the economical comparison, inasmuch as gas burnt in a properly regulated argand burner, with its proper sized glass, air aperture, and sufficient number of holes, gives an advantage in favour of gas consumed in an argand, over a jet burner, of from 30 to 40 per cent. At the same time it must not be overlooked that in many situations where great light is not required, it will be found far more economical to adopt the use of single jets, which by means of swing brackets and light elegant shades, becomes splendid substitutes for candles, in banking establishments, offices, libraries, &c. &c.

Note.—In Glasgow, Edinburgh, Dundee, Perth, and the Scotch towns generally, the Parrot, or Scotch Cannel coal is used; in illuminating power and specific gravity the

* 100lbs. of candles are estimated to burn 5,700 hours.

† The candles cost 3*l*. 2*s*. 6*d*.

‡ The Liverpool Old Company have since resorted to the use of Cannel Coal, and consequently very nearly assimilate to the Liverpool New Company in illuminating power.

gas produced is equal to that from the best description of Cannel coal in England. The price per 1000 cubic feet ranges about 9*s.*, with from 5 to 30 per cent. off for discounts, leaving the net price about 9*s.*, to be equal in the above table to 100 lbs. of candles.

Epitome of Experiments made in Gas produced from different qualities of Coal, and consumed in different kinds of Burners: tried at the Sheffield Gas Light Company's Works, and laid before a Committee of the House of Commons. By Joseph Hedley, Esq.

Date 1835.	Description of Burner.	Species of Coal.	Specific Gravity of Gas.	Distance of Candle from Shadow.	Gas consumed per Hour.	Height of Gas Flame	Equal to Mould Tallow Candles, 6 to the lb., 9 inches long each.	Gas equal to 100 lbs. of Mould Candles.	Cost of Gas at 8*s.* per 1000 cubic feet.	Cost of 100 lbs. of Mould Candles at 7*s.* 6*d.* per doz. lbs.
May.				*Inches.*	*Cubic Feet.*	*Inches*	*Candles.*	*Cubic Feet.*	£ *s.* *d.*	£ *s.* *d.*
8	Single Jet	Deep Pit	·410	75	1·	4	2·36	2415	0 19 3½	3 2 6
9	Ditto	Mortormley	·450	74	·95	4	2·434	2224	0 17 9½	
9	Ditto	Cannel	·660	61½	·7	4	3·54	1127	0 9 0	
8	Argand 14 holes	Deep Pit	·410	34	3·3	3¾	11·53	1631	0 13 0½	
9	Ditto	Mortormley	·450	33	3·1	3½	12·24	1443	0 11 6¼	
9	Ditto	Cannel	·660	29	2·6	3½	15·85	935	0 7 5¾	

Copy of Experiments made at the Alliance Gas Company's Works in Dublin, during the past year 1837. *By Joseph Hedley, Esq.*

Results of experiments on the qualities of various coals for the production of gas; its value in illuminating power; produce of coke, and quality; and other particulars important in gas-making :—

1st Experiment, Saturday, May 27th, 1837.—Deane coal (Cumberland), 2 cwt. of 112 lbs. each (or 224 lbs.) produce, 970 cubic feet of gas; 4 bushels of coke of middling quality; specific gravity of the gas, 475. Consumed in a single-jet burner, flame 4 inches high, 1$\frac{4}{10}$ths cubic feet per hour; distance from shadow 76 inches or 2.3 mould candles. Average quantity of gas made from the charge (6 hours) 4.33 cubic feet per lb., or 9,700 cubic feet per ton of 20 cwt. Increase of coke over coal in measure, not quite 30 per cent. Loss in weight between coal, coke, and breize 56 lbs., converted into gas, tar, ammonia, &c.

2nd Experiment, May 28th.—Carlisle coal (Blenkinsopp). 224 lbs. produced 1010 cubic feet of gas, 4 bushels of coke of good quality though small; increase of coke over coal in measure not quite 30 per cent. Loss in weight, same as foregoing experiment. Average quantity of gas made from the charge (6 hours) 4.5 cubic feet per lb., or 10,080 per ton.

Illuminating power of the Gas.

	Consumed per hour, single Jet.	Distance from Candle.	Equal to Candles.	Specific Gravity.
	Feet.	*Inches.*		
At the end of the first hour	1$\frac{1}{10}$	70	2·72	·475
Ditto ditto with 20-hole argand burner..................	5	25	21·33	·475
When charge nearly off	1$\frac{4}{10}$	85	1·84	·442
When charge quite off, with 20-hole argand burner..................	9	100	not 1	·266

3rd Experiment, May 29th.—Carlisle coal (Blenkinsopp). 112 lbs. produced 556 cubic feet of gas. Other products, loss of weight, &c., same proportion as foregoing experiment. Average quantity of gas made from the charge (6 hours) 4.96 cubic feet per lb., or 11.120 per ton.

In this experiment the quantity of gas generated every hour was ascertained; the illuminating power, the specific gravity, and the quantity of gas consumed by the single jet with a flame 4 inches high, was tried at the end of each hour, with the respective gases generated at each hour; and the following is a table of results.

Results.

Hour.	Gas produced.	Consumed per hour, per single Jet, 4 inches high.	Specific gravity.	Distance of Candle from Shadow.	Illuminating power equal to Mould Candles.
	Cubic feet.	*Cubic feet.*		*Inches.*	
1st.	150	11½.10ths. or 1-15	·534	70	2·72
2nd.	120	11	·495	75	2·36
3rd.	95	12	·344	75	2·36
4th.	95	15	·311	80	2·08
5th.	80	17	·270	85	1·81
6th.	16	29	·200	100	not one
Total..	556 or	92⅓ or 2	feet 9 inches.		

Average of the above gas, 6-hour charge.

92⅓	16-10ths. nearly	·359	81	2·03

Average of the above gas at 4-hour charge.

115	12⅓-10ths.	·421	,5	2·36

Production of gas in 6 hours 556 feet, or at the rate of 11,120 cubic feet per ton.
Ditto in 4 hours 460 feet, or at the rate of 9,200 ditto.

The relative value of these productions of gas is as follows, viz..—11,120 at 16-10ths per hour nearly (or 1.5916 accurately) and equal to 203 candles, the 11,120 feet would be equal to and last as long as 1597 candles, or 266⅙ lbs. of candles.

9.200 at 12⅓-10ths per hour (or 1-2375 accurately, and equal to 236 candles; the 9,200 feet would be equal to 1949 candles, or 324⅚ lbs. candles.

Now 266⅙ lbs. of mould candles, at 7*s.* 6*d.* per dozen lbs. will cost 8*l.* 6*s.* 4½*d.*, whilst 324⅚ lbs, of mould candles, at 7*s.* 6*d.* per dozen lbs. will cost 10*l.* 3s.

Shewing the value of 4-hour charges over 6-hour charges; and of 9,200 cubic feet over 11,120 cubic feet.

Note.—9,500 cubic feet of Wigan Cannel coal gas are equal in illuminating power to 859 1-6th lbs. of candles, which at 7*s.* 6*d.* per dozen lbs., will cost 25*l.* 10*s.* 5½*d.* It is also found that any burner with superior gas, will consume only about half the quantity it would do with common gas.

4th Experiment, May 30*th.*—Cannel and Cardiff coal mixed ½ and ½, together 112 lbs., produced 460 feet of gas; 2 bushels of coke of good quality; increase of coke over coal in measure about 30 per cent.; loss in weight, 41 lbs.; coke weighed 71 lbs., no breize. Average quantity of gas made from the charge, (4 hours) 4.1 cubic feet, per lb., or 9,200 per ton.

Illuminating power.—At end of first hour.

	Candles.		Cubic feet.
Distance of candle from shadow - - -	73 or 2.49	Consumed per hour, single jet, 4 inches high - -	12-10ths
At end of 2nd hour, do.	70 or 2.72	Do. do. do.	11½-10ths
At end of 3d hour	This gas very indifferent.		
Average of the three -	70 or 2.72	Do. do. do.	11½-10ths

Specific gravity 3.44; 5 feet per hour, with a 20-hole argand burner, equal to 14.66 candles.

5th Experiment, May 31*st.*—Carlisle coal, 112 lbs. produced 410 feet of gas; other products, same as in former experiments with this coal, but heat very low.

Illuminating power and produce of gas.

410 ft.	1st hour	120 cubic feet
	2nd	100
	3d	90
	4th	100

Average of this gas: specific gravity, 540; distance of candle from shadow, 55 inches, or 4.4 candles consumed per single jet, 9-10ths of a cubic foot per hour. 20-hole argand burner, 4 feet per hour, equal to 21.33 candles.

It is possible, from the superior quality of this gas, that a little of the Cannel gas made for a particular purpose, may have got intermixed with it in the experimental gas-holder and apparatus.

A variety of other experiments were tried

on different qualities of coal, and mixtures of ditto, too tedious to insert here, though extremely valuable, and all tending to show the superior value of gas produced at short over long charges; and also showing the importance and value of coal producing gas of the highest illuminating power; among which the Cannel coal procured in Lancashire, Yorkshire, and some other counties of England and Wales, and the Parrot or splent coal of Scotland, stand pre-eminent.

Note.—In all the foregoing experiments the same single-jet burner was used; its flame in all instances exactly 4 inches high.

The coal when drawn from the retort was slaked with water, and after allowing some short time for drying, was weighed.

General Summary.

For lighting London and its suburbs with gas, there are—

18 public gas works.

12 do. companies.

2,800,000*l.* capital employed in works, pipes, tanks, gas-holders, apparatus.

450,000*l.* yearly revenue derived.

180,000 tons of coals used in the year for making gas.

1,460,000,000 cubic feet of gas made in the year.

134,300 private burners supplied to about 40,000 consumers.

30,400 public or street do. N.B. about 2650 of these are in the *city* of London.

380 lamplighters employed.

176 gas holders; several of them double ones, capable of storing 5,500,000 cubic feet.

890 tons of coals used in the retorts on the shortest day, in 24 hours.

7,120,000 cubic feet of gas used in the longest night, say 24th December.

About 2500 persons are employed in the metropolis alone, in this branch of manufacture.

Between 1822 and 1827 the quantity nearly doubled itself, and that in 5 years.

Between 1827 and 1837 it doubled itself again.

NOTES AND NOTICES.

Paton's Specimens of Penmanship.—These specimens of art are certainly the most beautiful we have ever seen of the kind. The command of hand which they evince in their author is astonishing. We are free to confess that this is one branch of art to which the science of mechanism can lend but little aid; "the mechanism of the hand" is here all triumphant, and exercised under the guidance of a mind possessed of correct ideas of the beautiful; it has enabled Mr. Paton to earn for himself the rank of first penman of the day.

Hall's Patent Condensers.—We have been favoured with the perusal of a letter, dated Bombay, 11th September, 1839, from Mr. Clacher, the chief engineer of the East India Company's vessel, *Zenobia* (late *Kilkenny*), which has been fitted with Mr. Hall's patent condensers. Mr. C. states that the condensers were used during the whole of the voyage from Greenock to Bombay, that complete condensation was effected, the barometer showing a vacuum of from 28½ to 29 inches; that the vessel ran from Cork to St. Helena without blowing out; that upon then blowing out, no incrustation or dirt was found in the boilers; that from St. Helena to Bombay there was no blowing out, and upon the boilers being examined by Capt. H. B. Turner, mint engineer, he was surprised to see them so remarkably clean. The *Kilkenny* was sent from Bombay with the mail to Muscat, against the south-west monsoons; she made an excellent passage, and beat the *Berenice*. The consumption of fuel never exceeded 15 cwt. per hour; the engines are of 300 horse power. We have also seen a letter from Mr. R. Tayler, engineer of H. M. S. *Megæra*, to which Mr. Hall's condensers have been likewise applied. Mr. Taylor states that the engines of this vessel have been under his care for twelve months, and that Mr. H's principle of condensation "is good in every respect." The boilers had been blown off *once* since leaving England, in consequence of the joints of the mud hole doors giving way; the water had been seven months in them, and was "as fresh as first put in." "The method made use of to clear the flues (tubes of the condenser?) answers very well, and keeps them as clean as new—by dissolving 20 lbs. of potash in 6 gallons of water, and injecting it boiling into the condensers, once in every twelve days steaming."

The Armed Steamer "Nemesis."—There is now lying in the half-tide basin of the Clarence docks, Greenock, a very beautiful iron steamer, constructed by Mr. John Laird, of North Birkenhead, bearing the above name. She is fitted up with one engine of 120 horse power, and armed with two 32 pound carronades, the one fore and the other aft, which move on solid swivel carriages. Her draught of water is under four feet. Her crew will consist of 40 men. She will, it is said, clear out for Brazil, but her ultimate destination is conjectured to be the Eastern and Chinese seas. On Monday last she made an excursion as far as the floating light, for the purpose of trying her machinery, which was found to work admirably.—*Edinburgh Observer.*

Inventor of the Mule.—A daughter of the late Samuel Cromptou, sole inventor of the "mule," is compelled to apply for parochial relief; while the family of Arkwright, who, in the first instance, merely copied the invention, the machine, ranks among the wealthiest in the kingdom.—*Lancaster Guardian.*

Grain-drying Machinery.—The Dukes of Cambridge and Richmond, accompanied by Mr. Andelle, Mr. Marsh, and Mr. Kendall, lately inspected the patent revolving granary, for the preservation and improvement of corn, and were pleased to express themselves highly gratified at the introduction of so useful a machine into this country. It is intended to have it removed to Cambridge for the next great agricultural meeting.—*Times.*

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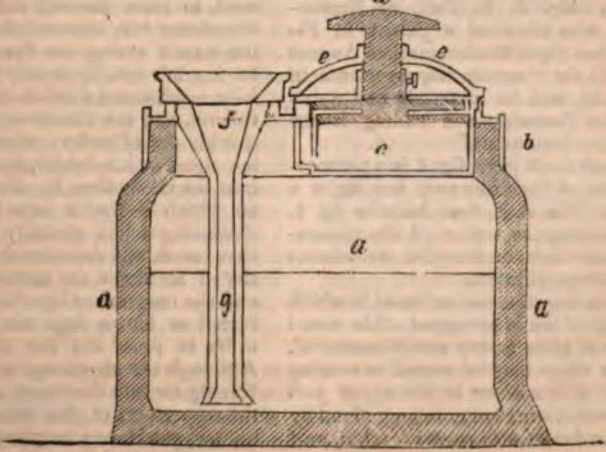
PERRY AND CO.'S PATENT FILTER INKSTAND.

Fig. 1.

Fig 2.



PERRY'S (DAFT'S) PATENT FILTER INKSTAND.

The subject of our first article this week is one of the most beautiful applications of a philosophical principle to a purpose of general utility which it has been our province to describe and comment upon for a long time. Not only is the patent Filter Inkstand beautiful in theory, but it answers well in practice, as we can cheerfully attest from some weeks constant use. The only contingency upon which its almost universal adoption depends, is the durability of its parts. If it will keep in good working order for a reasonable length of time (and there is not yet any sign of deterioration in the one we use,) no writer will do without it. For those who have only *occasionally* to make use of pen and ink, this apparatus will be of more service than to constant writers. To portable desks and table inkstands which are resorted to merely now and then, it is also specially adapted. Every one must have experienced the annoyance of writing with ink which has become musty, or thick as paste by exposure to the atmosphere; or what is as bad, the disappointment in summer weather of dipping his pen into a dry ink glass, filled, perhaps, with ink a day or two before, which had disappeared by evaporation.

We shall now proceed to describe the filter inkstand. It is designated with the name of the firm of Messrs. Perry and Co., who are the patentees by purchase: the inventor and patentee, however, is Mr. J. B. Daft, of Regent-street, who obtained a patent in February last (specification inrolled August 1, 1839,) for "certain improvements in inkstands, and in materials and apparatus for fastening and sealing letters and other documents."

On our front page fig. 1 is a perspective view of the inkstand, and fig. 2 a section. We shall first describe fig. 2, as explaining the action of the apparatus, and which explanation we extract from the specification.

"*aa* is the reservoir or vessel in which a supply of ink is contained; this vessel may be of glass or any suitable material, and the shape may be varied according to taste; *b*, is a cover to the upper part of the vessel *a*, such cover being affixed by cement or otherwise to such vessel, *a*, and in an air-tight manner; *c*, is a short cylinder affixed on the cover, *b*, by a screw or otherwise. On the lower part of this cylinder, *c*, is a cover or bottom, and there is an air-way passing from the top downwards through the side, and entering into the cylinder, *c*. The object of having the air-way in an indirect way into the cylinder is, in the event of the ink-stand being turned over, that the ink may not get into the cylinder, *c*. On the inside of the cylinder, *c*, there is a piston, which is well packed or fitted, in order to its moving air-tight in the cylinder, such piston being worked by a screw, *d*, working through the cover, *e*, of the cylinder, *c*. It will, therefore, be seen that the rising or lowering of the piston will influence the air in the vessel, *a*, for it will be evident that the air contained in the cylinder, *c*, when the piston is forced downwards, will be forced into the vessel, *a*, and will drive out a quantity of ink therefrom into the ink-holder, *f*, for use, and in the withdrawing of the piston to the upper part of the cylinder, *c*, the pressure of the atmosphere acting on the ink in the holder, *f*, will force back the ink into the vessel, *a*, and any deficiency of quantity of the ink from what previously existed in the vessel, *a*, will be compensated for by an equal quantity of air passing in through the ink-holder, and to the upper part of the vessel, *a*. The contact of air with the ink distinguishes ink-stands or ink-holders made according to this patent, from those previously in use, wherein a plunger or such like instrument has been used, to force the ink out of a vessel containing ink, into an ink-holder, such ink-stands acting on the principle of forcing ink out, by means of displacing it by a substance which is in contact with the ink, and are therefore liable to get quickly out of order; whereas, by this ink-stand or ink-holder, the ink is forced into the ink-holder, by the pressure of air which is forced into the vessel, *a*, displacing a like quantity of ink from that vessel, and therefore there is a quantity of air above the surface of the ink, and the instrument by which the air is forced or blown into the vessel, *a*, in order to press out the ink therefrom. Although the air-pump, or apparatus for forcing air into the vessel, *a*, is shown at the upper part of the ink-stand or ink-holder, yet it may be placed in any con-

venient position. The top of the ink-holder, *f*, is above the level at which the ink can at any time stand in the vessel, *a*; consequently, in case of any derangement of the air-pump or blowing apparatus, which would allow of a flow of air into the upper part of the vessel, *a*, the ink cannot flow away therefrom, which is a fault possessed by some constructions of ink-stands, wherein the ink is retained within the ink-stand or vessel by the pressure of the atmosphere, brought into action by withdrawing a plunger, acting on, or in, the ink.

"A tube, *g*, is affixed to, and descends from, the lower part of the ink-holder, *f*; this tube descends to nearly the bottom of the vessel, *a*, and there is a portion of fine woven silver-wire cloth, or other suitable material, covering the lower end of the pipe or tube, *g*, which acts as a strainer, and prevents any thick ink passing up to the ink-holder. The ink-holder, *f*, is affixed to a circular plate or cap having a screw, by which it is screwed over the opening formed in the cover, *b*, of the vessel, *a*, in an air-tight manner, and it is by removing this cap that the ink may be supplied to the vessel, *a*, or there may be a separate opening, having an air-tight covering or cork, at which ink may be supplied to the vessel, *a*, and it will be evident, that whatever be the position of the ink in the vessel, *a*, so long as it is above the lower end of the tube, *g*, on screwing down the piston in the cylinder, *c*, there will be a quantity of ink forced into the ink-holder, *f*, and, as above stated, on the withdrawing the piston upwards, whatever quantity of ink has been used or removed from the ink-holder, will be compensated for by a like quantity of air passing into the vessel, *a*, through the ink-holder, and it will be evident that my invention simply acts by pneumatic pressure on the ink, caused by a piston working in a cylinder, superadded to the vessel, *a*, and it is important to remark, that when the ink-holder, *f*, does not contain ink, the ink-stand may be turned over, and no ink will flow from the vessel, *a*, so long as the air-pump or blowing apparatus remains inoperative."

We think an arrangement of greater elegance might have been devised than that exhibited *in fig. 1; and* as the *invention works its way into* public use and favour, we shall, doubtless, see new patterns in which the principle is applied, having an eye to taste as well as utility. In this figure, A is the stopper, covering the aperture by which the ink is supplied to the glass ink-holder; B, the handle of the air-pump; C, the air-pump; D, the cover of the filter cup, or receptacle for ink, into which to dip the pen. The following are the directions for using the ink-stand:—

1st. Unscrew the stopper (A) and nearly fill the ink-stand, then replace the stopper and screw it tight down.

2nd. Turn the screw (B) of the air-pump (C) upwards, as far as it will go.

3rd. Remove the cover (D) of the filter cup, which may be placed on the stopper (A), then turn the screw (B) gradually down, and clear ink will instantly rise in the filter cup, which should only be about half filled, to allow space for expansion in case of any considerable change of temperature.

4th. The ink is withdrawn by turning the screw (B) upwards; this should be done when not in use, as ink fresh filtered is in the most perfect state for writing.

Should the ink not remain in the filter cup long enough, screw down the stopper a little tighter. It may be necessary occasionally to put a small quantity of sweet oil on the leather in the stopper, to keep it moist and soft, and also to introduce a few drops of pure sweet oil occasionally to the air-pump, for the like purpose, through the small hole in the side of the dome, which may be easily done with the point of a pen.

SIR JOHN ROBISON ON GAS BURNING FOR ILLUMINATION.

Sir,—You have favoured your readers with the interesting paper on the subject of *heating* by gas, by Sir John Robison, K. H. I have now the pleasure of sending another paper, on the best method of burning gas for the purposes of *illumination*, by the same distinguished author, which for the soundness of its views, and the decidedly practical character of its suggestions, well deserves the extensive circulation which your Magazine will procure for it.

It strikingly confirms the opinions of several talented contributors to your pages, and at the same time some of the

points are treated of in an entirely new point of view.

I am, Sir,

Yours very respectfully,

WM. BADDELEY.

London, Feb. 1, 1840.

On the best method of burning Gas for the purpose of illumination. By Sir John Robison, K. H., Secretary R. S. E., M. S. A.

"Has utile mecum."

The theoretical principles on which carburetted hydrogen gas may be used with the best advantage for the purpose of domestic illumination, have been so well laid down by the late Dr. Turner and by Dr. Christison, as well as by other chemists, that it would be superfluous to enter at all into this part of the subject, in a paper the object of which is to give such practical directions for the proper construction and management of gas fittings as may lead workmen to give the requisite forms and proportions to the parts, and may enable the consumers *to obtain the quantity of light they require from the smallest practicable expenditure of gas, and with the least possible inconvenience from the products of its combustion.*

It is very generally believed by workmen and others that the more freely the current of air is admitted to an Argand burner the better will be the light, and hence the burners and glass chimnies in ordinary use are made in such a way as to favour this view. No practice, however, can be more incorrect, or can lead to less economical results. An attentive observance of what takes place will show *that there is only a certain proportion of air required for the favourable combustion of a definite measure of gas.* If more air than this due proportion be allowed to pass up the chimney, the size of the flame will be reduced and the quantity of light diminished. If, on the other hand, less than the due proportion be admitted, the surface of the flame will be increased by elongation, but it will become obscure, and the quantity of light will decrease, owing to the escape of particles of unconsumed carbon. *A simple experiment will exemplify this. If the flame of an ordinary Argand burner be reduce,* by partially shutting the cock, to about half an inch high, the light will be pale and the flame blue, because the supply of air is too great for the small quantity of gas which is issuing. If partial obstruction be given to the access of air by applying a handkerchief under the burner and chimney, it will be found that the size of the flame and the quantity of light emitted will increase until it arrive at a *maximum*, when by further obstruction the admission of air will be reduced below the proportion required for the burning of the carbon, and the light will then diminish.

It appears, therefore, that the proportional size and shape of the burners, and the diameter and height of the glass chimnies, are by no means indifferent matters, but that much advantage may be gained or lost by giving them such forms and proportions *as may insure the development of the maximum degree of light which the gas is capable of affording* under ordinary circumstances.

As a general rule it may be considered that in all burners, whether well or ill made, the greatest quantity of light, *in proportion to the gas expended*, will be obtained when the flame has been raised as high as it will go without smoking. In proof of this the following experiment may be made. In any situation where there are three or four burners of the same size and with similar chimney-glasses, and receiving their gas through a meter (by which the expenditure may be measured), if one of these burners have its flame elevated as high as it can be made to burn without smoking, and if its expenditure per hour be accurately noted on the meter, if the other two or three burners be then lighted, and their flames be so regulated that their united lighting power shall be just equal to the large flame of the first burner, it will then be found on noting the expenditure, that it is much greater than in the case of the equal light from the single burner, and that the first burner which gives light equal to two or three others, consumes but two-thirds of the gas which they do; or if it be compared with three others giving together an equal degree of light, its consumption will be little more than half of theirs. It follows from this, that when a certain degree of light is required, such a burner

should be employed as is *capable of giving this light and no more*, and that it is bad economy to use a more powerful burner with a flame of less than its due height. This rule holds good with any number of burners, and is equally true whether they be well or ill made.

The same rule will apply to the individual jets of an Argand burner, as holds in regard to their united effect; and if, in any burner, the jets be of unequal heights in consequence of bad drilling of the apertures, or neglect of keeping them free of dirt, the consequence will be that when the flame is raised until the jet from the widest hole reaches the most advantageous height, those from the obstructed holes will be consuming the gas at a disadvantage, which will be greater or less according to circumstances, but will always be of greater amount than is generally supposed.

The experiments made by Drs. Turner and Christison serve to show that much smaller chimnies than those usually employed are required to burn the gas to the best advantage. Unfortunately, however, the dimensions most favourable to economy in one respect, are beyond the limit of economy in another; and when the glasses are made small enough in diameter to obtain the *maximums* of illuminating effect, they are liable to be softened by the heat, and *to be cracked if not accurately centred.* A compromise between the two evils must, therefore, be made; and if this be judiciously done, *a great improvement on the usual routine practice may be effected, a more beautiful and steady light be obtained at a less cost, and our domestic comfort be increased by the diminution of the heat and effluvia of the gas.*

For practical purposes, therefore, the following directions may be observed:—

Whatever diameter is given to the burner, the glass chimney should not exceed it by more than half an inch at the utmost. If the burner be less than ¾ths of an inch in diameter, the chimney-glass should not exceed 1½ inch in internal diameter. In any case its height should be no more than four inches above the mouth of the burner from which the jets spring.

The smallness of the interval which is in this way *allowed between the flame and the glass renders it* necessary that *the workmanship of* the supporting gallery be accurate *in order that the chimney may be held perpendicular and truly concentric with the flame.* Gas-fitters rarely give sufficient attention to this important point, and a large share of the expense from broken glasses is owing to defects in this particular.

In the ordinary mountings the gallery is put on the burner, which it seldom fits accurately; the glass, likewise, rarely fits tight into the socket of the gallery, and from these two causes it is often so much off the centre, or so far from being upright, that the flame cannot be raised to a proper height without risk of breaking it. This risk may be greatly diminished by a little change in the disposition of the burner and gallery. Instead of hanging the gallery on the burner, it should be placed beneath it, and fixed by screwing down the burner on it. In this case it is necessary to give the gallery an increased diameter, as the air both for the inside and for the outside of the flame must enter through its ribs. The burners should also be made conical instead of cylindrical; but this is not so important as drilling them with numerous holes, *at least double the number usually allowed*, as the closer they are the better—the expenditure being regulated by the stop-cock, and not by the number of holes.

In making the galleries great attention should be paid to having the rim and seat for the glass truly concentric with the hole through which the nozzle-screw, on which the burner is fixed, passes; the workman should have a solid wooden chuck of the size of the bells of the chimney-glasses, and should chuck the galleries on it, in order to drill the aperture through which the nozzle-screw is to pass. The outside and inside faces of this hole should at the same time be turned true, as if this be done with the proper care, the glass, the burner, and the gallery will all be true to the same axis when they are put together and screwed up. The hole through the gallery should not be tapped, as the burner is sufficient fixture for it, when screwed down over it. If this part of the work be well executed, even an indifferently made burner will perform well, and if it be ill done, the best burner will appear defective and be liable to break the glasses.

The arrangement of burner and g

lery here recommended is not incompatible with the use of plain cylindric glasses, but it will be found better to use what is sometimes called the French shaped chimnies, that is those which are used with the common Argand oil-lamps. The wideness of their mouths gives them a firm seat in the gallery, and if the length of the bell or wide portion of the glass be such that the neck or choke shall be on the level of the lip of the burner, and the upper part of the glass be 4 inches to 4½ inches long, then a favourable result will be obtained. It is expedient to obscure the lower part or bell of the glass, as the burner is thereby concealed and the flame appears to rise out of a thick wax candle. *No moon-shades should ever be used,* as besides intercepting a considerable portion of the light, they prevent the consumers from observing whether the burner and glasses be in good order and performing properly.

It is pretty generally imagined that the smoking of ceilings is occasioned by mpurity in the gas, whereas there is no connexion between the deposition of soot and the quality of the gas. The evil arises either from the flame being raised so high that some of its forked points give out smoke, or more frequently from a careless mode of lighting. If when lighting lamps, the stop-cock be opened suddenly and a burst of gas be permitted to escape before the match be applied to light it, then a strong puff follows the lighting of each burner, and a cloud of black smoke rises to the ceiling. This, in many houses and shops, is repeated daily throughout the year, and the inevitable consequence is a blackened ceiling. In some well-regulated houses the glasses are taken off and wiped every day, *and before they are put on again the match is applied to the lip of the burner, and the stop-cock cautiously opened, so that no more gas escapes than is sufficient to make a ring of blue flame,* the glasses being then put on quite straight, the stop-cocks are gently turned until the flames stand at three inches high. When this is done few chimney-glasses will be broken, and the ceilings will not be blackened *for years.*

Gas-fitters and lamp-makers generally put the stop-cocks in situations where it is difficult to get at them, and they make their heads so small that if they be in the least degree stiff, it is not easy to turn them gradually. Hence, when a little force is applied, they move by starts, and the flame is sometimes raised too high, or instead of being a little lowered is altogether extinguished. The remedy for this inconvenience is to make the cocks easily accessible to a person standing on the floor, and to make their levers so long that their movements may be easily graduated. The cocks and levers may easily be designed so as to form an ornamental part of the lamps.

The Argand burner being the most perfect and economical which can be used, unless where very small portions of light are required, it is unnecessary to say anything of the batwings and other fancy burners, especially as the only precaution to be taken with them is to take care not to raise them so high as to smoke, and never to use two or more low flames when the same degree of light can be got from one flame burning at its most effective height.

A mode of supplying Argand burners with a current of heated air has been lately proposed in Paris, and much praised in London. This is effected by having an outer glass of a diameter a little larger than the inner one. This outer glass reaches further down than the bottom of the burner, and is closed below by a metal plate. The air for the supply of the flame is made to pass down between the outer and inner glasses, where it gets heated; it then enters the inner glass and the centre aperture of the burner, and passing upwards, supports the combustion of the gas in the usual way. There is no doubt that by this arrangement a considerable improvement may be made in cases where ill made burners with wide and tall chimney glasses are employed; but if the experiment be tried with burners and glasses proportioned in the way recommended above, it will be found that no advantage is gained, and that the maximum effect has been attained by a simpler apparatus.

Before quitting the subject of burners it may be right to advert to a frequent cause of disappointment in their performance. The perfection of an Argand burner is, *that the flame arising from it should appear in a continuous cylindrical sheet, with a smooth upper edge, and without forking points.* This is sometimes

very difficult of attainment, however carefully the jet-holes may be gauged by the pricker. There are two causes for this irregularity; one is, that if the drill which is used be blunt, a little blaze is pushed aside by it when it is forced through the plate in which the jet-holes are pierced, this blaze adheres to the edge of the hole, and interferes with the passage of the gas, and being unequal in its effects, renders the flame forked. The other cause is, that the inside of the burner is seldom turned true, and that the shoulder in which the pierced disk rests, is not of equal width all round, and sometimes may be so thick in some places that the drill, when it gets through the disk, strikes against the shoulder;—this likewise interferes with the issue of the gas. To avoid these causes of irregularity, the following precautions are essential:—

When, in making an Argand burner, the seat for the disk is turned out, the inside space between the outer and inner walls of the burner, should be turned true for a quarter of an inch inwards, and no more shoulder should be left than just enough to support the disk in its place. The disk should then be put into its seat, *but not finally fixed*. The requisite number of holes should then be drilled in it, and slightly counter-sunk, to take off the barb. The disk should then be reversed (that is to say, the counter-sunk face should be put inward) and finally, fixed in its place. The blare which may have been pushed through by the drill will now be on the outside, and may easily be removed by the file, or by a slight counter-sinking, which is the preferable manner, as the smooth-edged holes will keep longer clean than those with a sharp arras; the application of an old tooth brush being sufficient to keep them in good order when in use.

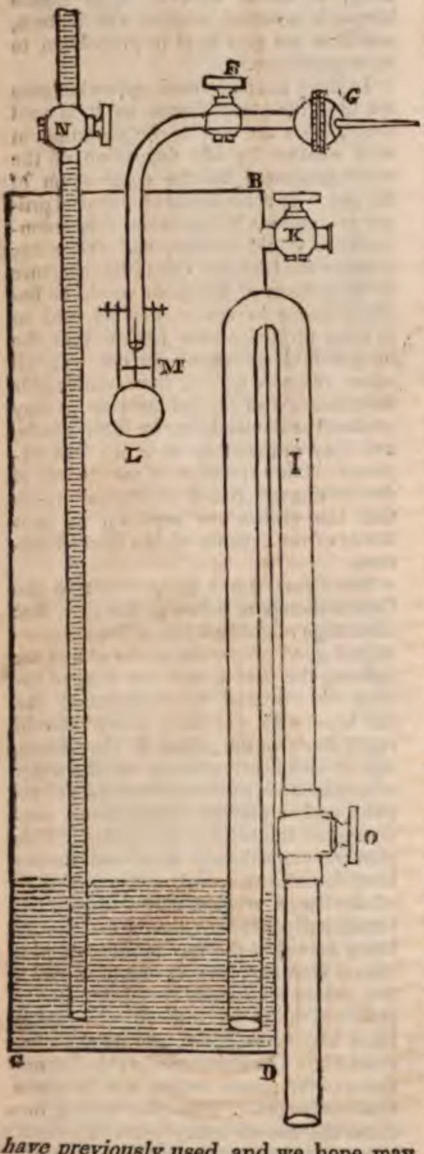
The above observations apply chiefly to the illumination of the interior of buildings, and it may be proper to notice the circumstances which require to be attended to in lights which, being placed externally, are in some degree exposed to the weather. The most important of these are the street lamps. These may either be arranged at considerable distances, and be fitted with powerful burners; or *the intervals between them may be smaller, and only a single jet be allowed for each.* Various local considerations must determine this, as wel[l as] some other points, but it should be kept in mind that the best small light is either the single jet of $3\frac{1}{2}$ to 4 inches high, or the fish-tail jet of 3 inches high; and that for more powerful lights *the Argand is preferable to all others.* The large bat-wing, so much used in large public lamps, is wasteful, smokes the lantern, and does not give light in proportion to its expenditure.

In most towns framed square lanterns are used for street lamps, as it is said that globes are apt to be obscured in cold weather by the deposition of the water generated by the combustion of the gas. It is no doubt true that if proper precautions be not taken this inconvenience would be felt, and the water which would trickle from the aperture in the bottom of the globe would be liable to freeze in severe weather, and so to close up the access for air that the lamp would smoke or go out. In all other respects globes have undeniable advantages over framed lanterns, as they protect the flames better in high winds, and they are kept up at much less expense. The experience of many years of the Edinburgh Board of Police proves that the globes are kept up at two-thirds of the expense of the framed lanterns.

Some years ago I pointed out to the Commisioners of police of this city, that advantage might be taken of the acknowledged good properties of the globes for lighting the streets, and the alleged defects be obviated by constructing the tin tops with chimnies which should reach down to the points of the flames, and by their current carry off the water of combustion while still in a state of vapour, and so prevent it from being condensed on the sides of the globes. This plan was immediately tried, and having been found successful, was adopted in all the lamps erected subsequently. It occasionally happens that from the jet being deranged the gas is directed past the tin chimney, instead of into it, and if the weather be cold, it is immediately observed that a deposition of water takes place inside the globe, and its sides become dim. The adjustment of the burner restores the proper action, and the globe remains bright. This plan having now stood the test of many years experience may safely be recommended for adopti[on] wherever new street lamps are erecte[d].

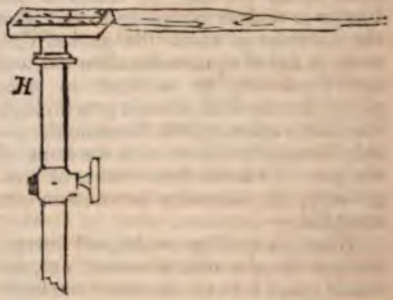
NIMMO'S HYDRAULIC BLOW-PIPE.

Sir,—With this we send you a sketch and description of a hydraulic blow-pipe, which we have used for some time in our work, and find it to possess considerable advantage over any other we



have previously used, and we hope may *·e of use to some of the readers of your* *gazine.*

A, B, C, D, is a cistern 12 inches diameter and three feet deep, close in all its parts. E is a pipe connected with a common water cistern; the higher the cistern is placed that supplies the water to the cistern of the blow-pipe, the stronger is the blast. This blast can be regulated by the stop cock F on the air pipe. G, a ball and socket joint for adjusting the air jet to the gas burner H; I, the syphon pipe for emptying the cistern;



K, a stop cock for admitting air when the water is discharging. If the blow-pipe is to be used with gas in place of common air, a connection is made with the stop cock K, to the gas pipe which fills the cistern of the blow-pipe with gas. Gas in place of common air is used with advantage for some purposes. L is a hollow ball or float, guided and supported by three wires outside of the air pipe, having one wire working inside of the air pipe, with a valve M on it. This valve is acted on when the water rises in the cistern and raises the float L, which shuts the mouth of the air pipe, and prevents the water entering into it, and at the same time shuts off the blast, and answers as a signal to empty the cistern of the blow-pipe. A blow pipe of the above dimensions will keep up a constant blast for twenty minutes, and can be discharged and ready for use again in about two minutes.

Directions for using the Hydraulic Blow-pipe.—Suppose the stop-cocks on the apparatus all shut: open the cock N which will admit a small quantity of water into the cistern of the blow-pipe; then light the gas burner on the gas pipe H; then open the cock F on the blast pipe, and you instantly have a strong blast, which is regulated by the cock F to any size. Suppose the blow-pipe has been used for some time, and

the water has risen so high in the cistern as to raise the float L and stop the blast; then you must open the cock O, on the syphon pipe, and the cock K, to admit common air, or gas if wanted; then shut the cock N, which cuts off the column of water from the common cistern, and the cistern of the blow-pipe will empty itself in about two minutes, the syphon pipe being of much larger size than any of the other pipes. A connection is made to the syphon or waste pipe conveying the water into a sink or soil pipe.

We are, Sir, &c.
P. & I. Nimmo.
Brass Founders.

Edinburgh, No. 6, North Bank-street,
Jan. 25, 1840.

IMPROVED COCK.

Sir,—In your 842nd number is given a drawing and description of Stocker's patent cock. The chief difference in which, from cocks that have been long made, seems to be the introduction of a spring, but in my humble opinion, from the way in which it is applied, I suspect there will be the same tendency from wearing to produce leakage as in the common cock. In the common cock, from the constant pressure on one side of the plug while in the act of turning, a continual wearing is produced on the opposite side, so that in the course of time an elongated circle will be produced, thereby admitting the liquid to pass the side of the plug on which the pressure exists. Now I suspect that any springs as applied in the patent cock,will have little or no tendency to remedy this defect in the common cock. As the bearing surface is much smaller in the patent than the common plug, the parts will be liable to wear much faster, and likewise the springs will be very apt to lose their elasticity. Owing to these defects, I am inclined to think that the patent cock can only act efficiently for a very short time About 15 years ago, having witnessed the defects of common cocks, my attention was turned to their improvement. and I afterwards made some sketches of new plans, two or three of which I have recommended to plumbers at different times since; but as I am not aware that any one has yet been made and

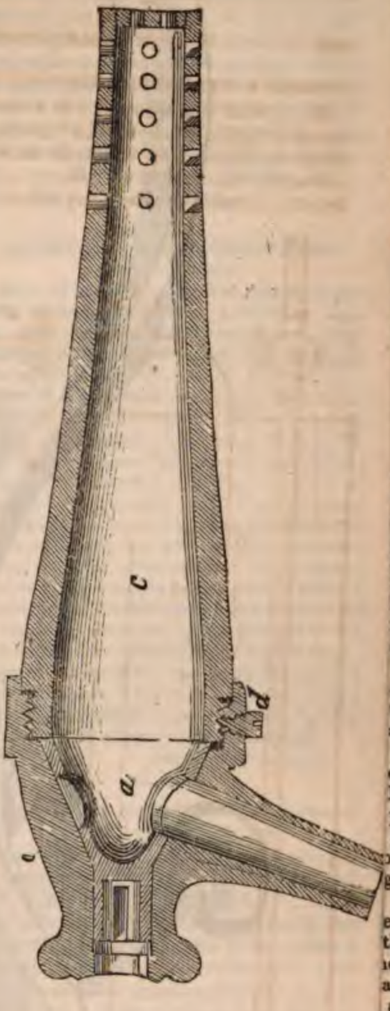
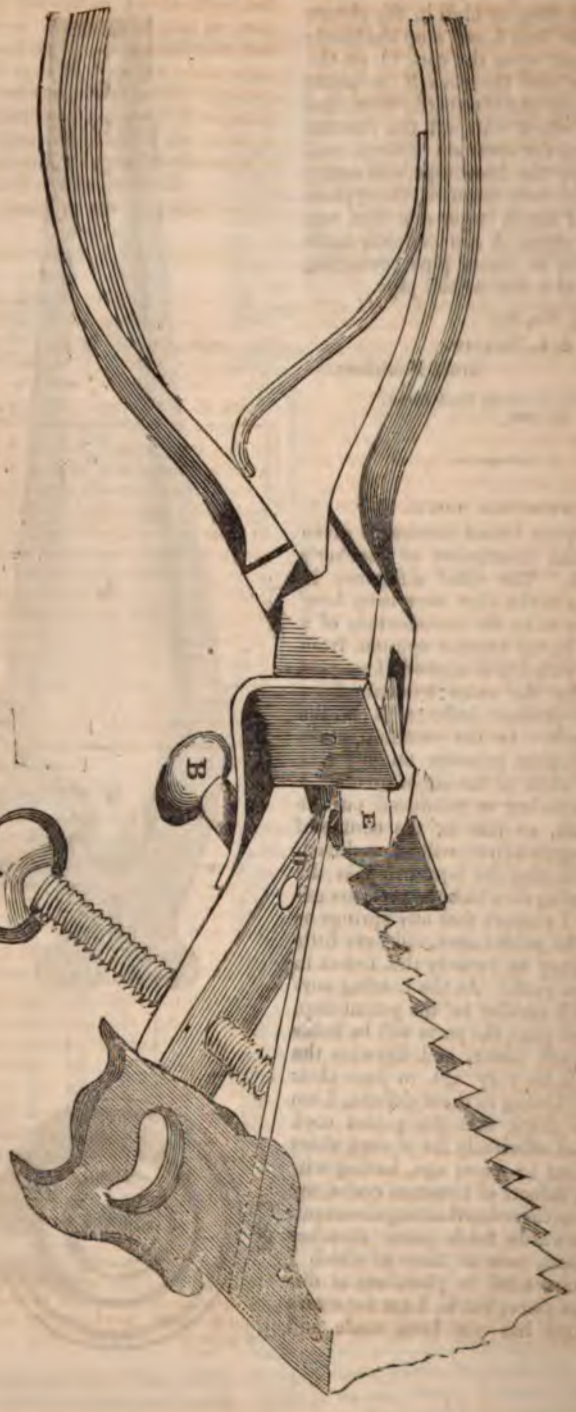


Fig. 1.


Fig. 2.



MOREHEN'S SAW SETTING INSTRUMENT.

ght into use, I send you one sketch, 1 I hope you will consider worthy ost of engraving for your pages. I is a longitudinal section of the the working part is composed of a w conical thimble *a*, having the er end prolonged parallel, to be on by the key in turning; this le is kept in its place by the part ng screwed up to it, but so as to of the thimble working easy; the *e* and *c* may then be secured in their ion by the small screw *d*. It will en that any wear that may take , will not affect the correct action is cock, as the thimble will only a little farther into the hollow co- seat, where it will be retained by ead of liquor acting as a spring in rtion to its height. There are two shown in the thimble, one over the ipe, the other exactly opposite; the is requisite to render the pressure e liquor in the thimble equal while turned, so that there may be no ncy to irregular wear. Fig. 2 is a view, showing the position of the for the key. In a few days I mean nd you a drawing and description ball cock, having some properties ruction, different from any that I seen in use.

emain, Sir, yours respectfully,

J.+J.

dnestone, Jan. 3, 1840.

SAW SETTING MACHINE.

,—A good method of setting saws great desideratum, and I have at h succeeded in getting a tool con- ted upon a principle which I have thought would well answer the pur- of setting saws; it is so simple, that dinary mechanic can set his saw as as those set with a hammer by an ienced saw sharper;* the accom- ing sketch will, I presume, be suffi- to show the way it is to be used. crew A may be raised or lowered to more or less set to the saw; the B is for the purpose of shifting the of copper C, so as to take more or old of the teeth; by this means from etail saw to a half rip may be pro- set, for while the saw plate rests the point of the screw A, and the upon the bottom jaw D, the upper E is pressed down by grasping with ight hand the limbs of the set, until the tooth comes in contact with the flat part of the bottom jaw; a saw of any size may be set in a few minutes by an apprentice boy, as well as as those set by an experienced saw sharpener. By the insertion of this (if you deem it worthy of a place) in your useful periodical, you will much oblige your humble servant,

H. MOREHEN, Builder, etc.

No. 4, Regent-street, Cambridge.

QUESTION IN NAVIGATION—LUNAR OBSERVATIONS.

Sir,—It is well known that sailors in general know little more of navigation than the mere practical part, and though they manage to knock out a sort of reckoning (the effect of habit), yet the rules orprinciples of the science are completely hidden to them. I confess myself, Sir, to be much in the same strait, and having been made feel the want of real fundamental knowledge, I have of late devoted myself to the study of spherical trigonometry; still I am at a loss to make out a demonstration of the rules given by Norrie and other writers on navigation for lunar observations. If any of the mathematical contributors to your Magazine would give a full demonstration for the rules of lunar observations, particularly that for finding the true distance, and what is denominated the auxiliary one B, by the method of versed sines, I am convinced they would win the gratitude of many of my profession, and especially of your obedient servant,

JOHN WATCHWELL.

ETHELSTON'S TABLE TO FACILITATE MENTAL COMPUTATION.

Sir,—Allow me to present you with an impression of my "Mechanical and Self-repeating Money Table." I have met with the most liberal support in the publication of it, from the most eminent literary, scientific, and mercantile men in this town and neighbourhood. 24,000 cards, at 1*d*. each, printed, face and reverse, the same as the copy I send you, were disposed of in about a fortnight; and I had the honour of being solicited by Mr. Fairbairn, Civil Engineer and Machinist, Member of the Council of the Literary and Philosophical Society of this town, to explain my law of the rotation of monied estimates before the society, and met with the encomiums of

* What is meant by setting saws is very different to setting a razor or other edged tool; the former is widening the teeth each alternate tooth a twist in a direction opposite to that before it; and the latter is sharpening the edge.

the scientific members for the simplicity and power of my new mode of mentally computing different amounts at any given rate. The base line of the table, rising by 1,000*s*. to the extreme left, is a constant periodic repeater, and if the table is carried forwards another period of six lines of estimates up to 24,000 at 1*d*.= 100*l*., and 2,400 at 1*d*.=10*l*., the shillings and pence of the 100 scale will be shown to be *alternate* periodic repeaters. Should you deem it worthy of publicity by your widely diffused and useful Journal, I should feel honoured.

In the meantime, I am,

Yours, respectfully,

EDWARDS ETHELSTON.

Hallewell-road, Cheetham-hill, in Manchester, 1, 23, 40.

A MECHANICAL AND SELF-REPEATING MONEY TABLE FOR FACILITATING MENTAL COMPUTATION.

Of Unlimited Power and Application, for forming Monied Estimates of any Number of Things, at any Rate, to One Thirty-second of a Penny.—Invented, September 27, 1839, by Edwards Ethelston, B.A., Camb. Scholar of Pemb. Col., Medalist of the Royal School of Medicine and Surgery, Pine-street, and M.R.C.S. London.

Nos. (a)	at 1*d*. (b)	½*d*. (c)	¼*d*. (d)	⅛*d*. (e)	1-16th. (f)	1-32d. (g)	Nos. (h)	1*d*. (i)	½*d*. (j)	¼*d*. (k)	At ¼*d*. (l)	⅛*d*. (m)
1000..	4 3 4	2 1 8	1 0 10	0 10 5	0 5 2½	0 2 7¼	100..	0 8 4	0 4 2	0 2 1	10.. 0 2½	0 1¼
2	8 6 8	4 3 4	2 1 8	1 0 10	0 10 5	0 5 2½	2....	0 16 8	0 8 4	0 4 2	2.. 0 5	0 2½
3	12 10 0	6 5 0	3 2 6	1 11 3	0 15 7½	0 7 9¾	3....	1 5 0	0 12 6	0 6 3	3.. 0 7½	0 3¾
4	16 13 4	8 6 8	4 3 4	2 1 8	1 0 10	0 10 5	4....	1 13 4	0 16 8	0 8 4	4.. 0 10	0 5
5	20 16 8	10 8 4	5 4 2	2 12 1	1 6 0½	0 13 0¼	5....	2 1 8	1 0 10	0 10 5	5.. 1 0½	0 6¼
6	25 0 0	12 10 0	6 5 0	3 2 6	1 11 3	0 15 7½	6....	2 10 0	1 5 0	0 12 6	6.. 1 3	0 7½
7000..	29 3 4	14 11 8	7 5 10	3 12 11	1 16 5½	0 18 2¾	700..	2 18 4	1 9 2	0 14 7	70.. 1 5½	0 8¾
8	33 6 8	16 13 4	8 6 8	4 3 4	2 1 8	1 0 10	8....	3 6 8	1 13 4	0 16 8	8.. 1 8	0 10
9	37 10 0	18 15 0	9 7 6	4 13 9	2 6 10½	1 3 5¼	9....	3 15 0	1 17 6	0 18 9	9.. 1 10½	0 11¼
10	41 13 4	20 16 8	10 8 4	5 4 2	2 12 1	1 6 0½	10....	4 3 4	2 1 8	1 0 10	10.. 2 1	1 0½
11	45 16 8	22 18 4	11 9 2	5 14 7	2 17 3½	1 8 7¾	11....	4 11 8	2 5 10	1 2 11	11.. 2 3½	1 1¾
12	50 0 0	25 0 0	12 10 0	6 5 0	3 2 6	1 11 3	12....	5 0 0	2 10 0	1 5 0	12.. 2 6	1 3
13000..	54 3 4	27 1 8	13 10 10	6 15 5	3 7 8½	1 13 10¼	1300..	5 8 4	2 14 2	1 7 1	130.. 2 8½	1 4¼
14	58 6 8	29 3 4	14 11 8	7 5 10	3 12 11	1 16 5½	14....	5 16 8	2 18 4	1 9 2	14.. 2 11	1 5½
15	62 10 0	31 5 0	15 12 6	7 16 3	3 18 7½	1 19 0¾	15....	6 5 0	3 2 6	1 11 3	15.. 3 1½	1 6¾
16	66 13 4	33 6 8	16 13 4	8 6 8	4 3 4	2 1 8	16....	6 13 4	3 6 8	1 13 4	16.. 3 4	1 8
17	70 16 8	35 8 4	17 14 2	8 17 1	4 8 6½	2 4 3	17....	7 1 8	3 10 10	1 15 5	17.. 3 6½	1 9¼
18	75 0 0	37 10 0	18 15 0	9 7 6	4 13 9	2 6 10½	18....	7 10 0	3 15 0	1 17 6	18.. 3 9	1 10½

Peculiarities of this Money Table.

Firstly. Its application is unlimited, being co-extensive with all numbers.—Secondly. It is produced all from the root of the table, included between the 1,000 and 6,000.—Thirdly. The £ (pound) line is found to infinity, by the mechanical addition of 4*l*. taken five times over, and then at the sixth place, merely adding the 5*l*. note, and then repeating the process.—Fourthly. The shilling line consists of a cycle or period of six figures; namely, 3, 6, 10, 13, 16, 0, repeated *ad infinitum*.—Fifthly. The pence line is a cycle of three figures; namely, 4, 8, 0. 4, 8, 0, in the six lines repeated also *to infinity*.—Sixthly. The black lines at every seventh place, indicate the Sabbatic-Rest, after which the process recommences.—Seventhly. The whole table is formed by halving the preceding lines.—Eighthly. The wholesale side, to the left of the two parallel dividing lines, headed (g), rises by a scale of 1,000's.—Ninthly. The retail side is formed on a scale of 100's, by taking one-tenth of the 1,000 line.—Tenthly. The second retail line, headed (l), rises by 10's, taking one-tenth of the 100 line.

N.B. Any monied estimate in the table, or a multiple of it, is found by the following means:—The line which contains the estimate wanted, is referred to by the Nos. (numbers) and the letter bracketed over the

head of the money lines, as (l) or (g). Thus Nos. 170 at $\frac{1}{4}$ is called 170 (l); and Nos. 170 at $\frac{3}{4}$ is called 170 (l), $\times$ 3. 1700 at $\frac{1}{2}$ is called 17.. (j), and so on for other sums, to be referred to in the table, or formed out of the table by the simple multiplication of the estimate given.

Specimens of Monied Estimates made by the Table.

Example 1*st.*—170 at $7\frac{3}{4}$ = 1st. 170 $\times$ 7*d.* = 1190 = 11.. (i) + 9. (l) $\times$ 4 = 4 11 8 +
0 7 6 = 4 19 2
2nd. + 17. (l) = (3 $6\frac{1}{2}$) $\times$ 3 = 0 10 $7\frac{1}{2}$

£5 9 $9\frac{1}{2}$

Example 2nd.—72,845 at $9\frac{3}{4}$*d.* 72,845 at 1*d.* = (6 $\times$ 12.. + 8.. + 45) = (£800 + £3 6*s.* 8*d.* + 3*s.* 9*d.*) = £303 10 5 at 1*d.* $\therefore$ £303 10 5 $\times$ $9\frac{3}{4}$ = [£2731 13 9, (+ $\frac{3}{4}$ of £303 10 5) or + £227 12 $9\frac{3}{4}$] = £2959 6 $6\frac{3}{4}$.

Note.—The usual signs of mathematics are used in the working of the table. Thus, + means add; 100 + 50, or 150. $\times$ means multiply. 6 $\times$ 12, means 72, of that denomination. $\therefore$ means therefore. = means equal; 6 $\times$ 12 are equal to 72.—(a) (b) (c) &c. refer to the respective columns of figures which they head.

ECONOMICAL STOVES, AND MODES OF WARMING APARTMENTS, ETC.

Sir,—I was induced to try and make a stove upon the plan suggested by "J. + J.," in No. 848, of your amusing and instructive Magazine. Wishing to warm a coach-house, and being unable to get one of the Chunk stoves, I made one as fig. 3, the following size (the size not being given by "J. + J."): Iron circular bottom or stand 14 inches diameter, with a 2 inch hole in centre for air and close to edge; a 2 inch hole for flue; a sheet iron case fitting close to stand *c*, 2 ft. high, with a lid to take on and off. The fire bucket sheet iron, 15 inches high, $9\frac{1}{2}$ inches wide top, and 7 in bottom, with grating 3 inches from bottom. This stove I raised on 3 courses of brick work to admit air to the bottom under grating, and conveyed a tin piping through the wall into a brick flue built expressly outside the building. After trying for a week daily I could not get it to draw, the smoke beat down the flue and through the air passage at bottom, and although sand was used, did not keep smoke out, and also the top being made to take on and off, cannot be made sufficiently tight to allow such a stove to be used with success in a dwelling house. I should feel greatly obliged if you could suggest where the error occurs, as I must presume "J. + J." had made such a stove as figs. 3, 4, and 5, before he sent his plans to you. I first tried fig. 1 with garden pots. It answered so as to give a strong heat, but I could not get *any* common garden pots to stand the fire—*all* the three in use got cracked in several pieces. This, as before stated drew well, but when I fixed the case on, and attempted to draw the smoke along the flue, the fire gradually went out.

Should "J. + J." see this, I should feel obliged by his addressing me on the subject through your Magazine, for although I have failed in a first attempt, I am willing with assistance to try again.

No. 851 contains an excellent engraving of the Chunk stove, none of which I have seen in this part of the country or elsewhere, but it strikes me the proportion I give of mine must be similar, and the plan not very unlike.

Do you see any objection to such a stove as "J. + J.'s" having the flue taken out 4 inches from the top, such as Arnott's and other stoves?

Can you inform me whether coke, coal, or wood and cinders, are the best for Dr. Arnott's stove, one of which I have just put up in a small country church? "J. + J." recommends cinders, or wood to his, some coke, and again, others coal, as giving the strongest heat.

In the case of one of the Chunk stoves being placed in a large hall, can you state whether the flue would draw with success if the smoke carried in a brick flue under a stone pavement a distance of six or eight yards, and then ascending; and how deep below the pavement would it be advisable to keep the flue, so as not to crack it?

Yours, &c.,

G. C.

Herefordshire.

[We transmitted the above communication to our ingenious correspondent "J. + J.," requesting him to give the explanations and information requested by "G. C.," and which he has favoured us by doing in the following letter. We are always happy to know of the practical application of the hints which we publish.]

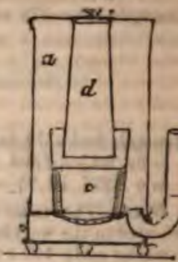
ECONOMICAL STOVES AND FUELS.

Sir,—The communication on the subject of stoves that appeared in No. 848, was written during a passage from Herne Bay to London, and having had to limit the minutiæ of the description and drawings to the length of the voyage, I necessarily was obliged to omit some things which would be essential in the using of such stoves by those not in the habit of reflecting on the causes of the ascension of hot air and smoke in flues. In the ordinary open flue, the heated air &c. ascends, because of its less specific gravity than the surrounding atmosphere, and will continue to ascend as long as a sufficiency of heat is generated to keep up a rarefaction in the flue, provided the flue has been properly constructed. In some cases when the wind is excessively high there are frequent puffs of smoke into the room, even when the flue is of the best construction. This evil arises from a partial vacuum being formed on the opposite side of the house to that on which the wind blows, thereby drawing a current of air through the flue and forcing the smoke into the room. To obviate this the door should be kept shut and a brisk fire kept up. An opening should also be made to the external air on that side of the room on which the fire is placed. On one way that I have found effectual is, to admit the air under the grate either at the sides or the back, as shown by fig. 1. Under an ordinary grate a light frame of iron is fixed, as shown at *a* in the sketch. This frame has a door hinged at the top and fastened at the bottom by a turn button. The under edge of the door should be kept so far above the hearth as to admit of its turning up to clear out the ashes. Now a grate fitted up in this way will almost in every case counteract a down blast; for when a strong puff of wind tends to force the smoke into the room the same puff forces a greater quantity of air into the fire, generating an extra quantity of heat, which renders the smoke so volatile as to counteract the downward tendency.

The action of a descending flue is very different from that of a common flue; the descending acts on the principle of the syphon, only inverted. By referring to fig. 2 it will be evident that the hot air, &c. from the fire will first rise to the top of the cylinder *a*, and gradually filling it would remain in that state till the fire became extinguished from being enveloped in gases where no free oxygen exists. If a pipe be added of the height of the fire box there will still be no draught; but if another length of pipe is added, and once filled with hot air from the fire, a draught will be established which will continue as long as any fuel remains in the *fire box*. The draught will be nearly in proportion to the difference of length of the legs of the syphon, provided the flue pipe is surrounded with a good non-conductor of heat.

Fig. 1.

Fig. 2.



I do not see that there is anything wanted to insure the proper action of your correspondent "G. C.'s stone," except a tin or sheet iron flue pipe of the same diameter at the bottom as the pipe he has got: but it would be better if the pipe increased in diameter a little at the top. I would recommend the pipe to be not less than seven or eight feet high. This pipe should be put inside the brick flue, and it would be all the better if surrounded with dry ashes within a foot of the top of the pipe. If filled up quite level there would be a danger of the pipe getting choked with leaves if trees, should such be in the neighbourhood. The top of the stove should be fitted in air-tight, or dropped into a groove of sand. If the cover admitair so much will be deducted from what should have passed through the fire, lessening the quantity of heat that would have otherwise been produced; and if much air is admitted at the top, it may lessen the heat so much that combustion will not proceed. If the fuel is supplied from the top, there can be no objection to the flue proceeding from near the top as in Arnott's stove, but the cylinder would not be heated so uniformly.

best fuel undoubtedly is good coke; cinders answer very well, but require to be oftener supplied, from their not containing so much carbon in the same bulk as good coke. Anthracite coal is by far the most lasting, and in many parts of the country the most profitable, but it is essential that the fire-box should be lined with clay to retain the heat, this fuel requiring a much higher degree of heat than coke to insure its decomposition. Wood does not answer so well as some of the more carbonacious fuels, for in the course of time a kind of hard pitchy matter is deposited on the interior of the cylinder retarding the passage of the heat to the room.

Where Welsh coal can be had at a reasonable price, I consider that a mixture of it with coke is the best and most profitable

fuel for Arnott's and other close stoves. When the coal is used alone it splits sometimes into such small pieces as to check the draught, but when mixed with coke a more porous mass is maintained, insuring a better combustion.

Some time ago I made an attempt at burning common coal in such a way that the smoke might be consumed; and I think that a similar arrangement would answer well for burning anthracite coal. Fig. 2 shows this arrangement; *c* is the fire-box lined with clay; *d* is a small cylinder tapering slightly upwards, the top is fixed to the outer case *a*. The fuel is supplied from the top filling the cylinder *d*, which is closed air-tight by the cover *e*. From this construction a more perfect combustion will be kept up, the air having only to pass through a small height of fuel will not impede the draught as when diffused through the whole mass of fuel.

In lighting my own stove to insure that result, I apply a blower* (similar to Clark's patent blower), to the air passage for about a minute or two, which forces the hot air from the fire into the flue, establishing a draught which never fails to go on as long as fuel is supplied. The flue is a cast iron water pipe about 2½ inches diameter, and about six feet long. A stove will act perfectly well with a flue descending under the floor for the distance "G. C." mentions, provided the pipes are made a little larger than they otherwise would be required, and encased with a good non-conductor of heat, which might either be air, dry ashes, or charcoal. When the fire is first lighted the blower would be an essential requisite. There will not be the slightest danger to the paving if the flue pipe is only one or two inches clear of it.

I am, Sir, yours, &c.,

J. J.

Goodnestone, Feb. 5, 1840.

MR. RENNIE'S EXPERIMENTS OF PADDLE-WHEELS AND OTHER STEAM-BOAT PROPELLERS.

Sir,—Your ingenious correspondent, Mr. Holebrook, has not been very successful in establishing the soundness of his opinions in his elaborate criticism on those experiments of Mr. Rennie given in your last month's Magazine, particularly on that portion relating to the spiral and conoidal propellers; for he assumed that the errors in the different tables, and omissions which are not a few, when corrected would support his views; this, however, does not appear to be the case as far as the corrections of your correspondent "J. M." has been made: on the contrary, he has in some respects very satisfactorily proved, if the corrections he has made can be depended on, that Mr. Holbrook's opinion is not tenable. Mr. Holebrook and many other persons in criticising the plan of propulsion by means of a spiral power always overlooked a matter of much importance, namely, that the water within the limits of the spiral has a tendency to revolve, and this the more rapidly as the speed of the screw is increased in the same manner as the water did in the experiment mentioned by Mr. Rennie, published in the *Philosophical Transactions*. This water, from the rapid circular motion, will have a tendency to be propelled laterally from the wheel, when its place will be supplied not only from the water before but also from that in the rear of the wheel, and consequently acts in retarding the speed in the same manner as the water in the rear of the hemisphere retards its motion more than the globe would be retarded under similar circumstances. The water can, in fact, with the conoidal propeller, be restored in the rear more effectually (as in the case of the globe) in the lateral direction than it can in the spiral, and I think more of its success depends on this fact than is due to the oft repeated objection to the loss from the angle of the spiral at and near the axle.

There is one part of your correspondent's, "J. M's.," explanations which I cannot well understand—where he states the six paddles immersed, meant the paddles of both wheels. Now the area of the six floats of each wheel immersed is stated in the table, which could not be the case if his explanation be correct. I am sure Mr. Rennie, a gentleman of well known scientific attainments, would not willingly give accounts of experiments so full of errors, intentionally to deceive, and if he would kindly give a more minute statement of the particulars it would be putting numbers of your readers under many obligations for the trouble.

I am, Sir,

Dublin, 4th July, 1840. M.

PATENT LAW ADJUDICATIONS.

Licensing under Letters Patent.—Exclusive Licences.—Protheroe v. *May.*

In all letters patent there is a clause providing that, if they shall become vested in, or in trust for, more than *twelve persons*, or their representatives, dividing, or entitled to

* The blower I use is made of wood, the idea of which I took from a large one I saw about ten years ago in the process of making at the foundry of Burgess and Heaton, Carlisle, so that Mr. Clarke was not the first, I apprehend, that applied the fan to domestic purposes.

divide, the benefit or profits obtained, the letters patent shall cease, and become void.

Before the judgment in this case, it was the opinion of some of our best lawyers, that a court of law would consider some classes of licences a direct interest in the patent, and that the person or persons holding such licenses, would each be counted as one of the twelve; the description of licences we refer to are those which are exclusive in their nature, such, for instance, as give to the holders exclusive licence to use particular parts of a patent, or to use the whole invention in particular districts, towns, parishes, or counties. All these descriptions of licences give to the holder an interest in the patent, of a peculiar nature, and very different to what an ordinary licence gives; and it was imagined that the exclusive character of such licences would invalidate a patent, if the number of parties interested in them, together with the patentee, exceeded the number of twelve. In consequence of this prevailing opinion, within the last few years, there having been several acts of parliament applied for and obtained, to allow of more persons than twelve to be jointly interested in holding a patent. By the present judgment it has been settled that a licence is no part of the patent, whether of an exclusive or simple nature, and that any number of persons may hold exclusive licences under a patent, and that patent still be valid.

In the case a bill was filed by the plaintiff, for the specific performance of an agreement to grant an exclusive licence under a patent granted to Arthur Dunn, for "certain improvements in the manufacture of soap," 24th August, 1838; and a question was raised as to the validity of the patent, in consequence of certain exclusive licences which had been granted by the assignees of the patent, to Messrs. Guppy and Protheroe, of all the privileges of the patent, within the city of Bristol and 35 miles round it. Under the licence they used and exercised the said patent invention within Bristol, and such other places within 35 miles thereof, as they thought fit, and afterwards assigned the licence, and the benefit thereof, to or in trust for a company or co-partnership consisting of more than twelve persons.

The patentees also afterwards gave and granted twelve other similar exclusive licences to use and exercise the said patent right and invention in twelve other several districts, of which twelve licenses, eleven were granted severally to eleven individuals, (that is to say, each to one distinct person), and the twelfth was granted to a partnership consisting of thirteen persons. The districts covered by the licenses are parts of England only. They do not comprise the whole of England. In order to settle the question at law, the Vice-Chancellor directed a case, detailing the facts above-mentioned, and with the following queries, to be submitted to the Judges of the Court of Exchequer for their opinion:—

1. Has the grant of the said first-mentioned exclusive license to Philip Protheroe and Samuel Guppy, invalidated the letters patent of itself, without reference to the subsequent facts?

2. Has the assignment to, and vesting of, the said first-mentioned license in the said partnership of more than twelve persons, invalidated the letters patent of itself, and without reference to the other facts stated?

3. Has the grant of the said twelve last-mentioned exclusive licenses, or of any, and which of them, invalidated the said letters patent?

4. If the third question should be answered in the affirmative, would the result be the same if the last of the twelve licenses had been granted to a less number than twelve persons?

5. If the grantees of all the licenses were to coalesce, and become jointly interested in such licenses, would the letters patent be thereby invalidated, if not otherwise invalidated?

6. Would the letters patent, if not otherwise invalidated, have been so, if the districts, covered by the licenses, had included the whole of England, Wales, and Berwick-upon-Tweed?

7. Would they have been so, if such districts had included the whole of England, Wales, Berwick-upon-Tweed, and the Colonies?

Answers of Judges of the Court of Exchequer.

We have heard this case argued by counsel, and considered the same, and are of opinion,

1. That the grant of the first-mentioned exclusive license to the said Philip Protheroe and Samuel Guppy, did not invalidate the letters patent.

2. That the assignment to, and vesting of, the said first-mentioned license in the said partnership of more than twelve persons, did not invalidate the letters patent.

3. That the grant of the said twelve last-mentioned exclusive licenses, nor of any of them, did not invalidate the said letters patent.

4. That if all the grantees of all the licenses were to coalesce, and become jointly interested in such licenses, the letters patent would not be thereby invalidated.

5. That the letters patent would not be

invalidated, if the districts, covered by the licenses, had included the whole of England and Wales, and Berwick-upon-Tweed.

6. That they would not have been so, if such districts had included the whole of England, Wales, Berwick-upon-Tweed, and the Colonies.

Dated this 20th day of November, 1839.

(Signed) ABINGER.
J. PARKE.
J. GURNEY.
R. M. ROLFE.

Wooden Pavement Case.—Parkin v. *Harrison.*

Vice-Chancellor's Court, Jan. 17, 1840.

The plaintiff in this case is the patentee of a mode of paving streets with wood (described in *Mech. Mag.* No. 858), whose patent was granted on the 9th day of April, 1839, and he applied to the Vice-Chancellor for an injunction to restrain the defendant from laying down certain pavement at Whitehall, after a plan subsequently patented, that is, in June in the same year, by a Mr. Hodgson (see also *Mech. Mag.* No. 858,*) and which plan he alleged to be an infringement upon his patent. The case was very fully argued by counsel on both sides, and numerous drawings and models were exhibited for the information of the Court. The pith of the case, and the drift of the arguments on each side, will be gathered from the Vice-Chancellor's judgment, which was as follows:—

The Vice-Chancellor.—In this case the question will be first of all whether the plaintiff has a valid patent, and next, whether the defendants have infringed the patent. With respect to the plaintiff's patent, I must observe, that, in the first place, it never appears to have been acted on; there is no instance alleged in which it has ever been said that there has been any dealing on it whatever, except a strange course of treaty on the subject arising out of an agreement between the plaintiff and one Mr. Grubb. That having been the only dealing on it, it is impossible to say that any validity is to be attributed to the patent on that account; for the patent was dated the 9th April, and the specification was filed on 9th Oct., and there has been a treaty about it and that is all, and consequently, therefore, the Court is not bound to say that the length of time is such as of itself *prima facie* establishes the legal right of the patentee.

I cannot but myself think, that the Court is at liberty to look into the specification and see whether it is *prima facie* reasonably clear that it is good; and when I look at this specification, I am not willing to give any final judgment on it, because it is not my province so to do, but I have considerable doubt whether this specification is sufficiently good as to this matter—"And 7thly, my improvements in roads and ways consist, according to my first mode, in paving them with blocks of wood having the grain inclined to the horizon in some angle varying from about 45 degrees to about 70 degrees, the grain of all the blocks leaning in the same direction or towards the same point of the compass." It is observable, that where a party is speaking about angles, he is speaking of a matter of quantity about which it is extremely easy to speak with accuracy; and, according to the language that is here used, it is really and fairly a doubtful matter, that is to say, legally doubtful, whether that thing which might have been expressed with sufficient accuracy has been so expressed, or whether it is possible to make out exactly what it was that the party did mean. Now, strictly speaking, the words as they stand, do only imply that it was to be at some angle not 45 or 70 degrees. I am quite sure that the party did not mean that; and, therefore, I have a case before me in which, in the words of the specification, the party uses language in which all that can be said is, that with reasonable certainty it does not express the parties meaning. In the latter part, where he speaks of what he had before spoken of, "having regard to my seventh head of improvements of roads and ways, I say that the first and second mode is the paving with blocks of wood having the grain inclined to the horizon from about 45 to about 70 degrees, and I claim the dowelling of the blocks together in paving, when slanting or leaning in opposite directions." I cannot but think here that the party meant to have it understood that the dowelling itself is a part of the invention, and, therefore, *prima facie* I should have thought it rather contrary to one's common experience to have it in the year 1839, claimed as an invention that certain blocks of wood were to be fas-

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* Some parties interested in Mr. Hodgson's patent, have complained of the remarks made in reference to this invention, in the Magazine above cited, and also state that his patented mode of paving is not there fairly represented. The account there given was drawn up from memory, after a mere perusal of the specification of the invention at the Inrolment Office, our reporter being prohibited from taking the slightest memorandum or note on the spot by the rules of the office. Our readers will perceive, therefore, that it is not unlikely that some inaccuracy may have occurred. We shall (probably next week) publish an authentically correct account of the plan.—ED. M. M.

tened together by means of dowelling, and I doubt whether that is any invention at all. I cannot but think that on such a patent as this, before the Court does anything so as to interfere against the defendants, it ought to take some method to have it established that the plaintiff has got that legal right which he pretends to have.

With respect to the second part of the case, supposing that the plaintiff's patent is good, is it so clear that what the defendants have done is a violation of the patent? Mr. Hodgson and the Count de Lisle say, "that they verily believe that the invention for which the above-named plaintiff took out the letters patent in the bill mentioned, did not, and does not, in any respect, correspond to, or resemble the invention of this deponent, Richard Hodgson, communicated to him by the other deponent, Augustus De Lisle;" and they say, "that the plaintiff hath improperly laid claim to the said last-named invention, and hath endeavoured to include the same, or such part thereof as relates to wood pavement, in the specification of his said patent." The fair inference of that affidavit is, that the patent, in fact and truth, is for an invention different from the defendant's invention, but that the plaintiff wishes to have it thought that his specification is for the same invention.

Now, with respect to the defendant's (Hodgson's) invention, as I understand it from his specification, it is a precise and definite thing, and is an invention by means of cutting a cube in a certain manner which is detailed in the specification itself; and it appears to me, that where the defendant does point out a particular mode of cutting the solid body, the cube, in such a manner as that invariably and of necessity there must be figures precisely of the same shape produced, always having certain given angles upon the planes of the sides, and, therefore, always producing, when laid transversely one across the other, that certain isoscles triangle of which he speaks, which enables him exactly to determine and place the same in all, however numerous, in which can be introduced the hole and the pin, which will have the effect of uniting several blocks with each other, in the manner that is easily shown by those *instruments.** I cannot but think that he, *prima facie* at least, has *invented a definite thing*, which does materially differ from that *very vague and indefinite thing* which the plaintiff has described in his specification.

Now, I think, therefore, that before I interfere by Injunction, I ought to direct the plaintiff to bring such action as he may be advised; in that action he will have, in the first place, to make out that his patent is a good and legal patent, and then he will have to make out, that by the act which the defendant has actually done, if the patent be good, it has been infringed; both these points can be determined simply by directing that the plaintiff shall bring such an action as he may be advised, and to direct the motion to stand over, with liberty for both parties to apply.

* *The Court referred here to the models of the pavement at Whitehall.*

THE IRON TRADE: TRACING ITS RISE AND PROGRESS, WITH ITS PRESENT STATE. BY HARRY SCRIVENOR.

Such is the title of a work, the publication of which has been recently commenced in connection with our cotemporary the *Mining Journal*. We cannot pass the wording or punctuation of this title without comment; it would stand more correctly thus—"The iron trade: its rise and progress; and its present state." We do not apprehend that our author means to trace the rise and progress of the iron trade *with* its present state, because we do not see how the various steps of genius and enterprise by which it has gradually attained its present perfection and eminence can be connected therewith, other than as one step rises out of, or supersedes another, but has no relation except to its immediate predecessor. The "rise and progress" of the iron trade might be traced *to* "its present state"—but not *with* it. The expression "*rise and progress*" is too, a contradictory phrase—a parody, but an incorrect one, upon Gibbon's expressive title "Decline and Fall." To use a mechanical illustration, "rise" is a vertical increase; "progress" generally a horizontal, but may include both the one and the other, and then the use of the former word is a tautology. Retaining the present wording, the title would be nearer rectitude by the transposition of the colon from its present situation to after the word "progress." Our practical readers will perhaps think these remarks superfluous, or hypercritical, and we shall therefore say no more upon this point, but leaving the shell, proceed to the kernel.

The subject proposed to be treated by Mr. Scrivenor is a most important one, and he has the advantage of coming into

r field. We call this an advantge · than otherwise, because it leaves thor free to state in a straight for- manner all the information that he ollect from the various sources to · he may have reference, untram- d by the previous appropriation of ame sources of fact by others. If formation be conveniently arranged, analytically, synthetically, or chro- ically, and the authorities be carefully ed to, so that every statement may ged therefrom as to its veritableness, degree of dependence to be placed it, we shall rest content, and our r will well fulfil his task. Com- upon the different points of interest work as they arise, we must of e expect, and if it be not warped to rt some preconceived notions, fa- e theory, or local prejudice, we receive it with pleasure and re- The very fact of the ground unoccupied, leads us to expect a the more valuable, as it shall be ore confined to statistic and de- ive matter; unclogged with the sion of the opinions of previous ians.

protean character of iron has been ourtrayed by Dr. Ure in his *Dic- y of Arts and Manufactures*;—we lready quoted the passage, but it vell bear repetition, and indeed, we venture to say, become the ng motto and text of essays and tations upon this universally useful ; and this, notwithstanding it is a paraphrase of a passage by which will be found in the account in his Natural History.

very person knows the manifold uses truly precious metal; it is capable of ast in moulds of any form—of being out into wires of any desired strength ness—of being extended into plates ts—of being bent in every direction—of harpened, hardened, and softened at pleasure. Iron accommodates itself to all our wants, our desires, and even our caprices; it is equally serviceable to the arts, the sciences, to agriculture, and war; the same ore furnishes the sword, the ploughshare, the spring of a watch or of a carriage, the chisel, the chain, the anchor, the compass, the cannon, and the bomb. It is a medicine of much virtue, and the only metal friendly to the human frame. The ores of iron are scattered over the crust of the globe with a beneficial profusion, proportioned to the utility of the metal; they are found under every latitude and every zone, in every mineral formation, and are disseminated in every soil."

From so extensive a text we are not unreasonable in expecting a good sermon.

The first portion of Mr. Scrivenor's work now published, contains the introduction, the first, and part of the second chapters. The additional value which the operations of science and labour gives to iron has been commonly illustrated by the comparison of rough iron with the watch spring. We have another and more tensive example quoted from Dr. Friedenberg's German edition of Babbage's "*Economy of Machinery and Manufactures.*"

"The increased value of manufactured iron, compared with the raw material, cannot, perhaps be better illustrated than by taking as an example the price of Berlin cast-iron ornaments, which, in some cases, is equal to upwards of 55,000*l.* per ton, while the cost of raw ore, from whence the article is manufactured cannot be taken at more than thirty shillings per ton.

"In one of the principal manufactories of this description in Berlin, that of Devaranne, such is the fineness and delicacy of those separate arabesques, rosettes, medallions, &c., of which the larger ornaments are composed, that nearly ten thousand go to the pound, the price increasing in proportion to the fineness, as will be seen by the following table, which gives the selling prices at this establishment:

	No. to the cwt.	Price of each article.	Price p. cwt. of the same.
kles, 3½ inches long, and 2½ inches broad	2640	£0 2 6	£330 0 0
k chains, 18 inches long, and 1 inch broad, and composed of 40 separate pieces	2310	0 6 0	693 0 0
celets, 7 inches long, and 2 inches broad, and composed of 72 pieces ... pair	2090	0 8 6	888 5 0
dems, 7½ inches high, and 5¼ inches broad	1100	0 16 6	907 10 0
igné needles, 2½ inches long, and 1½ inch broad, and composed of 11 parts	9020	0 4 6	202 10 0
igné earrings, 3 inches long, and ⅞ inch broad, and composed of 24 pieces ... pair	10,450	0 5 3	2743 2 6
rt buttons	88,440	0 8 0	2948 0 0

The consideration of the "iron trade" will not, we presume, extend to the processes by which the metal is manufactured into its various destined articles of use—such, for instance, as the different manipulations and machinery of cutlery, needle-making, nail-making, and so on; if so, we should say that our author contemplates too extensive a range of inquiry. Dr. Lardner has already well, though, from circumstances, restrictedly, treated this division, in his volume on *Iron and Steel Manufactures*. Mr. Scrivenor should terminate where Dr. Lardner has commenced, leaving out of the question the short account the Doctor gives of the ancient history of the metal, and of its general mode of preparation. Those things which, in the work we refer to, are given in brief, Mr. Scrivenor, we presume, proposes to speak of in detail, and with amplitude; and those which are fully described, merely to give thereto a general reference.

From what our author states in the Introduction, we are led to form a high opinion of the probable value of the work as a book of reference and of standard authority. The author thus states the "rise and progress," and success of his researches.

"The importance and use of official documents will be readily admitted, and these the author has been fortunate enough to procure, from a very early period up to the present time, by means of assistance afforded him by parties connected with this and other countries, and which has thus enabled him to bring together a mass of information on the subject as valuable as it is authentic. The official documents relating to our own trade extend over a period of 130 years, commencing in the year 1710, when returns connected with it were first moved for in Parliament. Most of these returns were procured shortly before the destruction of the Houses of Parliament by fire, when, in all probability, those of an earlier date were destroyed. The official returns of other countries extend over a considerable period, and the author's best thanks are due to those who afforded him the means of obtaining so much information necessary to his object. He may here observe, that he has been greatly strengthened in his idea of publishing the result of his labours (which were first commenced for his own information, and on which he has bestowed a considerable portion of his leisure hours for some years), by the readiness with which members of Parliament and others came forward to assist him when informed of the nature of his inquiries. The late Speaker (now Lord Canterbury), on the introduction of a highly respected member of the House of Commons, gave him free access to the library of the House, without the usual condition of being accompanied by the member at whose instance the privilege was granted—a regulation from which there had never been a deviation except in one previous instance. Through the kindness of the same member (Dr. Phillimore), the Speaker then gave an order on the printer to the House for the author to be furnished with the whole of the printed returns. In the statistics submitted all may feel an interest, not only in tracing the progress, and marking the improvements, but also in the useful and valuable deductions which may be drawn by the political economist and the man of business, in regard to the effect likely to be produced hereafter on the iron trade."

The path he has laid out for himself, the author thus points out—

"It is proposed, in the following work, to trace the origin and use of the metal—the advance and improvements which have taken place—to consider the important question, how far the trade of this country is likely to be interfered with by foreign manufacture?—and, at the same time, clearly to demonstrate the immense advantages we possess over other countries, and the improbability of their interference, to any extent, sufficient to affect our permanent prosperity. In the first chapter it is proposed to show the early discovery of iron—the knowledge which the ancients had of this metal—and the purposes to which it was applied. The subsequent chapters will then trace the working of it in this country, from the time of the Romans to the almost total destruction of the manufacture, from the want of fuel, after the attempts to make coal available as a substitute for charcoal had failed, and note the progress and loss of the trade in Ireland, and the rise and history of the manufacture in the British colonies in America, up to the period of the war, when they established their independence. It is then proposed to continue its history in Great Britain, from the invention of the blast-engine, the establishment of coal as fuel, and the introduction of certain valuable improvements in the manufacture of iron down to the year 1830, and previously to the further consideration of the home manufacture, to trace the foreign trade in its progress in each country separately, commencing with Spain, where the use of iron was better understood, and where it was earlier applied than in any country of which we have information." * *

concluding chapter will contain the ments which have taken place from 1830 to the present time, and form l summary of the work, with obser- on the present state and prospects trade. The work will be accom- by numerous and valuable tables from their scarcity and complete- ll, it is hoped, render it one of au- and reference), and illustrated by igs."

look forward with considerable to this concluding chapter, from we expect to derive much valu- ıd interesting information, and hich we shall take the liberty ropriating largely, for the in- on of our readers, accounts of discovered processes.

nentioned that the work was pub- n connection with our cotempo- e *Mining Journal and Review*. ages of quarto, it is announced, given every month; and when ed, the whole work on the iron ill be sold in a separate form, at rate. We may mention *en pas-* at this mode of publishing works nection with newspapers, is of ntiquity. We find in the "Gen- s Magazine," nearly a century ention made of "Clarendon's of the Rebellion," and "Boyer's ry of Queen Anne," being given a week, gratis, with the newspa- There is also another instance in 's "New History of England," as issued gratis, in portions, with hester newspaper, about 1760. hat time the plan has been re- adopted, in some instances the per to float the history, and in the History to float the news- We do not include either the *Journal* or the *History of the ade* in this remark; one has, and er promises to have, sufficient ıd talent evinced in its produc- e one to retain and the other to a respectable position in scien- erature. With regard to Mr. or's work, we have criticised in a easure by anticipation; speaking he has promised to do rather what he has done. He has thus advantage of having the oppor- to profit by a critic's advice, n other cases can only tickle or

We shall conclude the present notice of "The Iron Trade," by a secondhand quotation of Pliny's Chapter on Iron, from his "Natural History."

After treating on other metals, Pliny observes—"It remaineth now, in the next place, to discourse of the mines of iron, a metal which we may well say is both the best and the worst implement used now in the world; for, with the help of iron, we break up and tear the ground—we plant and plot our groves—we set our portyards, and range our fruitful trees in rows—we prune our vines, and, by cutting off the superfluous branches and dead wood, we make them every year to look fresh and young again. By means of iron and steel we build houses, hew quarries, and cut in stone—yea, and in one word, we use it to all other necessary uses of this life.

"Contrariwise, the same iron serveth for wars, murders, and robberies; not only to offend and strike therewith in hand, but also to reach and kill afar off, with divers sorts of darts and short; one whiles discharged and sent out of engines, another while launced and flung by force of the arm—yea, and sometimes let fly with wings. This I take to be the wickedest invention that ever was devised by the head of man; for, to the end that death may speed away the faster to a man, and surprise him more suddenly, we make it to fly as a bird in the air, and to the arrow, headed at one end with deadly iron, we set feathers at the other, whereby it is evident that the mischief proceeding from iron is not to be imputed to the nature of it, but to the unhappy wit of man.

"For good proof we had already by many experiments otherwise, that iron might be employed and occupied without any hurt or harm at all to mankind. And, verily, in those capitulations of peace, which, after the expulsion of the kings, Porsena, king of the Tuscanes, tendered into the people of Rome, I find this express article and imposition—that they should not use iron, but only about tillage of the ground. And, as our chronicles of greatest antiquity have left recorded, it was not thought safe to permit writing and engraving letters with a style of iron. Certes, in the third consulship of Pompey the Great, by occasion of a tumult and commotion raised within the city of Rome, for the murder committed upon the person of P. Clodius, there was an edict came forth (which is now extant upon record), after this form—'*Ne ullum telum in urbe esset.*' 'That no man throughout all Rome shall be seen to wear a weapon.' Nevertheless, men did not forbear and give over to do some honour unto iron; also, in some other occa-

sions of this life, tending to the entertaining of civility and humanity, for Aristonides, the cunning artificer, minding to represent in an image the furious rage of Athamas, beginning now to cool and be allayed, together with his repentance for the cruel murdering of his own son, Learchus, whom he flung headlong against the hard stones, and thereby dashed out his brains, made a temperature of brass and iron together, to the end, that the rusty iron, appearing through the bright lustre of the brass, might lively express a blushing red in the countenance, beseeming a man confused and dismayed for so unnatural a fact. This statue is, at this day, to be seen at Thebes; within the same city there is another image of Hercules, all of hard iron or steel, which Alcon, the famous workman, made of purpose to signify the undaunted heart of that deified Hercules, who underwent and endured all labours and perils whatsoever. Here, also, in Rome, we may see certain drinking cups of steel, dedicated in the temple of Mars the Revenger.

"But to come unto the nature of iron, herein appeareth still the same goodness of Nature, that this metal, working such mischief as it doth, shall be revenged of itself, and receive condign punishment by its own rust. See also the wonderful Providence of Nature, who maketh nothing in the world more subject to death and corruption than that which is most hurtful and deadly to mankind.

"As touching mines of iron ore, they are to be found almost in every country, for there is not so much as the island of Ilua (Elba), here within Italy, but it breedeth iron. And lightly wheresoever any such be, they are easily discovered, for the very leer of the earth, resembling the colour of ore, betrayeth where they lie; and when it is found out they burn, try, and fine it, as other veins of metal. Only in Cappadocia there is some question and doubt made, whether, in the making of iron, they be more beholden to the earth that yieldeth the ore, or to the water for the preparing and ordering of it? For this is certain, that unless the vein of ore be well drenched and soaked with the water of one river there, it will never yield iron out of the furnace.

"As for the kinds of iron, many there are and all distinct. The first difference ariseth from the diversity of the soil and climate where the mines be found; for in some places the ground and the position of the heavens do yield only a soft ore, and coming nearer to the substance of lead than iron; in another the metal is brittle and short, standing much upon a vein of brass, such as will not serve one whit for stroke and nail to bind cart-wheels withal, which tire, indeed, should be made of the o
which is gentle and pliable. More
some kind of iron there is that serveth
if it be wrought in short and small works
namely, for nails, studs, and tacks, empl
about greaves and leg-harness: ano
again, that is more apt to take rust
canker than the rest. Howbeit, all so
iron ore are termed in Latin *strictur*
word appropriate to this metal and t
other—*à strigenda acie*, 'of dazzling
eyes, or drawing a naked sword.'

"But the furnace itself, where th
or ironstone is tried, maketh the gre
difference that is, for therein you shall
to arise, by much burning and fining
purest parts thereof, which, in Lati
called *nucleus ferri*—'the kernel or hea
the iron' (and it is that which we call s
and the same also of divers sorts; fo
best is it that hardeneth the edge o
weapon or tool: there is of it which se
better for stithy or anvil heads, the fac
hammers, bits of mattocks, and iron cr
but the most variety of iron cometh b
means of the water, wherein the iron,
hot, is oft soon dipped and quenched f
be hardened. And, verily, water only w
in some place is better, in others wor
that which hath ennobled many place
the excellent iron that cometh from t
as, namely, Bilbilis, in Spain, and Tar
Comus, also in Italy, for none of these p
have any iron mines of their own, an
there is no talk but of the iron and steel
cometh from thence. Howbeit, as r
kinds of iron as there be, none shall m
in goodness the steel that cometh fro
Seres, for this commodity also, as l
ware as it is, they send and sell with
soft silks and fine furs. In a second d
of goodness may be placed the Parthian
And, setting aside these two countri
know not where there be any bars or
tempered of fine and pure steel, indeed
all the rest have a mixture of iron mo
less; and, generally in the west parts o
world wherein we live, all our steel is
more soft and gentle temperature than
of the Levant.

"This goodness of steel, in some coun
ariseth from the nature of the mine,
Austrich; in others from the handling
temperature thereof, like as by quenc
as I said before, and, namely, at S
where the water serveth especially for
purpose; and no marvel, for we see a
difference in whetting and sharpening
edge of any instrument between oil
stones that barbers use and the co
water grindstones, for, surely, the oil g
a more fine and delicate edge. Fur
more, this is strange, than when the o

in the furnace it yieldeth iron liquid, ar as water, and afterwards being into bars and gads, when it is red-s spongious and brittle, apt to break ve into flakes. And, considering the ce that is between the nature of oil er (as I have said), this is to be ob- that the finer any edged tools be, ner is to quench them in oil for to the edge, for fear lest the water should them overmuch, and make the edge ady to break out into nicks, than to d turn again. But, wonderful it is ll, that man's blood should have such in it, as to be revenged of the iron at shed it; for, being once embrued it is given ever after eftsoons to rust ker.

ncerning the loadstone and the great l and amity between iron and it, I write more amply in the due place. it, for the present thus much I must ay, that iron is the only metal which h strength from that stone—yea, and the same a long time, insomuch, as e thereof, if it be once well touched bed withal, it is able to take hold of ieces of iron; and thus otherwhiles see a number of rings hanging to- in manner of a chain, notwithstanding not linked and enclosed one within . The ignorant people, seeing these us rubbed with the loadstone, and g one to another, call it quickiron. any wound made by such a tool, are ager and angry than by another. one is to be found in Biscay, scattered d there in small pieces by way of ion (for that is the term they use); s not that true magnet or loadstone, which groweth in one continued and I wot not whether these be so or glass-makers, and serveth their well in melting their glass as the for no man yet hath made any expe- thereof. But sure I am, that if one the edge, back, or blade of a knife th, it doth impart an attractive virtue thereunto, as well as the right magnet. re I cannot choose but acquaint you e singular invention of that great t and master deviser, of Alexandria, pt, Dinocrates*, who began to make hed roof of the temple of Arsinoe all et or this loadstone, to the end, that that temple the statue of the said princess, made of iron, might seem to hang in the air by nothing—but prevented he was by death, before he could finish his work, like as King Ptolemy also, who ordained that temple to be built in the honour of the said Arsinoe, his sister.

"But to return again to our iron: of all mines that be, the vein of this metal is largest, and spreadeth itself into most lengths every way, as we may see in that part of Biscay that coasteth along the sea, and upon the ocean beneath, where there is a craggy mountain, very steep and high, which standeth all upon a mine or vein of iron. A wonderful thing, and in a manner incredible —howbeit, most true, according as I have showed already in my cosmography, as touching the circuit of the ocean.

"Iron made once hot in the fire, unless it be hardened with the hammer, dost soon waste and corrupt. So long as it looketh but red, it is not ready for the hammer, neither should it be beaten before it look white in the fire. Besmear it with vinegar and allum, it will look like copper or brass. If you be desirous to keep any iron-work from rust, give it a varnish with ceruse plaster and tar, incorporate all together, and this is that composition which is called, by the Greeks, antipathia. And some say that there is a kind of hallowing iron within the city, called Zeugma*, seated upon Euphrates, wherewith King Alexander the Great sometime bound and strengthened the bridge over the river there; the links whereof, as many as have been repaired and made new since, do gather rust, whereas the rest of the first making be all free therefrom."

PROTECTION OF DESIGNS OF PATTERNS UPON WOVEN FABRICS.

The Registration of Designs Act, which was passed last year, establishing a copyright in "designs for articles of manufacture," when of metal, for three years, and when of other materials, for one year, especially excluded from its operation, lace, linens, cottons, calicos, and muslins, which articles were the subject of previous Acts of Parliament, protecting them for a term of three months only. Last week, Mr. E. Tennent, in the House of Commons, moved the second reading of a bill to extend the twelve months copyright to

* [Dino]crates, an architect of Macedonia, who [propose]d to Alexander to cut Mount Athos in the [form of] a statue, holding a city in one hand, and in [the othe]r a basin, into which all the waters of the [mountai]n should empty themselves. This project [was howev]er rejected as too chimerical, but he em[ployed] the talents of the artist in building and [beautify]ing Alexandria.—*Lempriere.*

* Zeugma, a town of Mesopotamia, on the western bank of the Euphrates, where was a well-known passage across the river. It was the western boundary of the Roman empire, and, in Pliny's age, a chain of iron was said to extend across it.—*Lempriere.*

these excepted articles. The debate is interesting to those concerned in our manufactures, we therefore publish a report thereof. The most feasible objection, in appearance, to the bill, is that stated by Mr. Phillips, that foreigners would copy the copyright design, and supply the market. But this would be easily provided against, by making it penal to *sell* goods, as well as to manufacture them, with the pirated design thereon. This is the case with regard to pirated designs under the act of last year.

Designs of Copyright Bill.

Mr. E. TENNENT moved the second reading of the bill for extending the copyright in designs upon woven fabrics from three months to twelve. It was not the object of the bill to introduce any new principle into the law, but simply to give efficiency to a principle which the existing law already recognised and professed to provide for, but which in the lapse of time had become utterly nugatory. The act which first proposed to secure to the inventors of original designs the profits of their own labours was first passed in 1787, and limited the protection to two months. This act was renewed from time to time; but at length, in 1794, it was made perpetual, and the term of protection extended to three months, at which point it had remained unaltered up to the present. But during the 40 or 50 years that have intervened, many circumstances have concurred to render that which was then an effectual protection merely a nominal and a deceptive one; amongst which, as the most prominent, may be noticed the application of steam to navigation, thereby placing the foreign market almost upon a par with the home as regards priority in design, and the improvements in engraving and printing, which have nearly quadrupled the facilities for the rapid reproduction of any pattern. He (Mr. Tennent) was, in fact, within the mark, when he stated that from 150 to 200 pieces of goods could now be produced in one day by the improved process, when not more than 15 to 20 could have been printed by the old machinery of some 30 years ago; and such was the rapidity with which designs can now be copied and reproduced, that in one very recent instance the patterns of one eminent house in the city, of their style of dresses for the season, having been surreptitiously obtained by another establishment a few days before publication, rival articles were within eight days announced for sale in imitation of them, and at a much lower cost than those of the original inventor. does the evil complained of as arising f the present brief term consist merely in that it is too short a period within whi designer could be repaid by ordinary for his outlay and investment; but the jury lies here, that parties willing to chase are still deterred from giving exte orders for original designs during the t months of protection, conscious that very few weeks, on the expiration of term, and before the demand has ce they will be plentifully supplied wit cheaper imitations. Besides, the very toms of the trade have a tendency to those who exist by copying the desig others a facility for that purpose, whi effect reduces the term of protection below the scanty limit of three month asmuch as it is necessary, one mon least before a season opens (say in the n of January, previous to the spring s which commences in February), to d to the warehouseman a book of the pat prepared and ready for delivery, in orde his riders may exhibit them to his tomers, and thus enable him to comput extent of his orders. And not only is question whether this delivery of the terns be not a "publication" in the e the law, thus fixing the date from whic three months' protection is to be comp and therefore diminishing the term w which the goods are protected in the ma from three months to two, but it giv the intending copyist a full month to pare his imitations for subsequent sale. that in no one respect can the present t short and ill-defined as it is, be regard that adequate protection and security v the law holds out and professes to pro But it so happens that at the present ment the protection sought, at least b most important branch of the trade, calico-printers, is less required for the l market than for the foreign trade; and one peculiar feature of the case v strongly recommends copyrights of thi scription to a more summary protection those of literature or the higher branc art, which are of a permanent and value comparatively, that the taste v constitutes the value of these is perpe fluctuating, and that their owners ha better security for their property tha proverbially fickle one of the fashion c day. Now, it so happens, that just no one of these capricious fluctuations, wo and silks are almost exclusively in dema the home market, so that calicoes and p cottons are manufactured almost entir the American and West Indian trade the house will readily perceive how u

te the term of three months is to tection to a branch of manufacture n at so vast a distance. In the first e tastes of the two countries are so that goods for the colonies must e prepared from designs totally dis- n those intended for home consump- process of great labour, expense, y, three or four designs being per- cted from 100 or more, which are e, and after being reduced to scale, ire two or three months to engrave ptete before one single piece can be r delivery: when ready, the goods ped, say for the West Indies, a book ns being first handed to the shipping t by the manufacturer. And now he practical effect of a short time right. Before a course of post from can bring a repetition of the order, wright has expired; the patterns in time have been copied from the books deposited with the English and he has goods in imitation of dy for exportation, of inferior qua- doubt, but likewise at an inferior m the diminished cost of production, ps these very imitations are already in the confidence that they will ar- e West Indies just about the time right of the originals shall have austed. The original proprietor of ever receives a second order, and reasons—first, because he cannot sell at so low a price as the imitator, no expense for designs, which he y means of a sheet of tracing paper, has uniformly less expense for en- is patterns, being already reduced and ready for transferring to the oller; and secondly, because the itation destroys the positive value ore elegant original, and puts an e check upon its sale. And again, same consideration which operates me trade, the foreign purchaser will e first instance give any extensive m his knowledge of the prevalence, and of the certainty of his speedily the copies at much reduced prices. American trade a similar difficulty d an equal injustice is sustained, aggravation, that the tastes, of that nd this being nearly similar, and sons of trade simultaneous, the must be earlier despatched across tic, and of course the risk of their tercepted and copied in England increased. Besides, had the original a sufficient protection for the home o as to in ure here an adequate com- there, *the fact of his being* enabled *e goods for two markets* from one set of designs, would enable him so to reduce his American prices, as to augment and re- tain his export trade, whilst, owing to the present unprotected condition of the trade, even the home-market, as he (Mr Tennent) had already shown, is curtailed in its fair extent of orders by an apprehension of piracy both in England and from copies transmitted across the Atlantic. He had thus endea- voured to show that neither for the home trade, the colonial, nor the American market, did the existing law hold out a fair and sufficient protection, and that it was indis- pensable that it should be immediately amended by an extension. The principle of protection had already, as he had shown, been recognized by the law for nearly half a century, but, owing to the change of cir- cumstances within that period, it had now become merely deceptive and a delusion, and his object in this bill was to render it real and efficient. If, instead of being mere copyists in the arts of design, this country was to maintain the lead which she had hitherto taken in manufactures, this amend- ment of the law was indispensable. No prudent man, in the present state of the law, would go to the expense of employing original artists at high salaries, conscious that his designs were to be almost immedia- tely invaded and appropriated by a host of copyists; and, besides this, parents would not send their children to learn the business of original designers, if they were informed that pirates and imitators, who lived upon the inventions of others, were to be per- mitted to shut them out from a chance of employment. Under such circumstances, our School of Design must perish; and we must be contented in this branch of trade to be mere copyists of the French, the Swiss, and other nations who do give an adequate protection to enterprise and original talent. So important is this subject, that it was brought under the consideration of the house last year in two bills by the late President of the Board of Trade, Mr. Poulett Thomson. By one he extended the present protection of three months to silks and woollens, which were totally unprotected before (another in- stance of the necessity of suiting these laws to the circumstances of the times, neither silks nor woollens being printed in England when the original law was passed, whilst the printing of linens, which was then common and protected by the act, is now absolutely obsolete and unknown); and by the other bill, Mr. Thomson gave to all other fabrics except these, the very term of protection which he (Mr. Tennent) now wished to con- fer upon the entire—namely, twelve months. In fact, Mr. Thomson's bill went so far as to give to some articles a protection of

three years, but this he (Mr. Tennent) conceived as much too long a period for woven fabrics as three months had been found to be too little. But he could not see why room papers, oilcloths, and other inferior articles were to have a twelve months' protection, and the most valuable of our manufactures, silks, chalies, and cachmeres, were to have a lesser term. In every communication he (Mr. Tennent) had had with the printers of Lancashire, of Scotland, and of Ireland, they each and all concurred that twelve months would be the very lowest term which would afford them an adequate security, and render the protection promised and held out by the law a reality and not a delusion. With this view he had so framed his bill, and he hoped the house, admitting its justice, would give its sanction to its enactment. He then moved the second reading.

Mr. MACLINNON seconded the motion. He recommended that a collection of designs, patterns, and similar works of art, should be made, and placed in the National Gallery, where the public might have an opportunity of inspecting them.

Mr. W. WILLIAMS said, the bill would affect a very important branch of manufactures, with which it would be most injudicious to meddle, unless a strong case was made out. By the present law the copyright lasted three months, and might be protected, if it were infringed, by an injunction in the Court of Chancery. He should therefore move as an amendment, that the bill be read a second time that day six months.

Mr. LABOUCHERE thought that very ample protection was already given to the copyright of designs by the acts passed last session by Mr. P. Thomson. Great evil might be caused if the duration of copyright were too far extended, and if persons were not obliged to have their designs registered. He was afraid that without registration, which could be easily brought into practice, it would be impossible to continue the existing system of granting patents*. He would not, however, oppose a short extension of the time for which protection was given. On the whole, he would be disposed to agree to the second reading of the bill, reserving to himself the right of moving in committee to substitute a period of six months instead of one of twelve.

After a few words from Mr. WARBURTON and Mr. LABOUCHERE,

Sir R. PEEL observed that he had great doubts upon the subject to which the bill of the honourable member referred. It might be very inconvenient to extend the protection already granted much further, while at the same time the present period might be too limited; and then came the question whether, at the same time that the protection was extended, registration should also be required. He was afraid that there would be much difficulty in requiring registration of patterns so evanescent as these matters; and yet if registration were not required, he did not exactly see why the parties asking for protection for their inventions should be put on the same footing as other trades who could register. He was sorry that the house should be asked to legislate on subjects like the present without possessing sufficient practical information on the subject. He could not, for his own part, form a satisfactory opinion on the subject without inquiry. He should, however, certainly support the second reading of the bill, but at the same time he would not pledge himself to agree to all the details in the committee.

Mr. O'CONNELL said, that practical experience showed that the present term was too short, but he was not prepared to say that an extension of the period to twelve months might not be too long. That was a subject, however, for the consideration of a committee.

Mr. M. PHILIPS did not wish to take the extreme course recommended by the hon. member for Coventry, but he thought that there were strong reasons why the house should weigh well any proposition which went to alter the law on a subject of this importance. If the period of protection were extended from three months to six months, it was possible, considering the facility of communication between this country and the continent, that the inventions thus protected might be copied by the Swiss and French printers, who would supply our markets, and thus, while we endeavoured to protect a few individuals, they themselves would suffer, and the national interests would be neglected. Instead of protecting a few, the measure might ruin a great many. It appeared to him that the question had not been generally taken up by the trade, and he did not think that there was any strong feeling among the calico printers on the subject, but at the same time he should not feel himself justified in hastily taking any steps to shut out inquiry, whether the protection now given might not be extended from three to six months. He therefore should not oppose the second reading of the bill.

After a few words from Mr. HUME,

* Either this remark of Mr. Labouchere's is misreported, or the honourable member is not acquainted with the subject upon which he speaks. As most of our readers are aware, full descriptions *of all patented subjects are enrolled, or registered, within six months from the grant thereof, or in default the patent is void.*—ED. M.M.

Mr. E. TENNENT replied. He should be happy to concur in the suggestion which had been made in the course of the discussion, and he would take the second reading of the bill now, on the understanding that it should at present proceed no further, but be referred to a select committee upstairs.

The amendment was then withdrawn, and the bill was read a second time, and ordered to be referred to a select committee.

MODE OF CONDUCTING MINES IN BELGIUM.

At a recent meeting of the "Scientific Society," the secretary read a communication from Mr. A. Dean, C.E., entitled "Essay on the Coal Fields of Belgium," from which we extract the following:—

"In Belgium as in France, the right to all minerals, not already granted or conceded to individuals or companies, is vested in the crown, under certain modifications. If a proprietor of land imagines minerals to exist under his estate, he is at liberty to make such researches as he may think necessary to determine that point, when, if successful, he immediately applies to the government for a 'concession' or grant of the minerals within a certain district, having given four months notice in the parish or commune in which it is situated, of his intention so to do, in order that all other claimants, if there be any, may prefer their claims, if they desire it.

"Should the proprietor of an estate, under which minerals exist, refuse to work them himself, when applied to by the government or any individual, then any other person may compel him to make the necessary researches by paying double the amount of the damage they may cause in the prosecution of such works. The fine reserved by government is 5 per cent. upon the net profits, and to prevent fraud in this respect, the country is divided into sections, each of which is under the supervision of an engineer, belonging to the Bureau des Mines, whose duty it is to examine the books of the company, and to see that the works are carried on in a proper and miner like style.

"The miners vary very much in different districts in point of skill; those of Liège and Mons being in general able and expert workmen, whilst those of Namur are far behind; indeed so much so that it is not twenty years since they were totally ignorant of the use of the mariner's compass, and on the first introduction of one into the district, they imagined the magnetic needle was an animal, which they designated as 'le petit bête,' and by that name the instrument is known to the present day. *The mines in the neighbourhood of Liège and Mons are, generally speaking*, well conducted, although considerable improvements might be made in the modes now employed in sinking the pits, driving and sustaining the ground.

"The staff in most of the large mines consists of an engineer, master miner, and several under masters, whose duties are entirely confined to the underground management; clerks and enginemen.

"The men are paid at per yard forward or in depth, as it may be for sinking and driving, and by the cube yard or some standard measure, for getting the coal. In some mines women are employed in pulling or shoving the small waggons employed to transport the coal on the trains, which are laid down throughout the gateheads or galleries, which traverse the mines. The general scale of wages is, for a good miner, 1½ to 2 francs per day, and candles or lamps are supplied by the proprietors when the work is done by the day, but in matters of bargain all charges are included in the price given, except hauling the stuff that is broken; this is done by the proprietors. Women and boys get from 12 to 14 sous per day, and some trifling allowances extra.

"One of the greatest charges on the mines is for the wood necessary to support the ground whilst the coal is being worked out. In many instances, owing to the 'roof' of the mine being bad, it is necessary to leave the timber in, as it would be impossible to take it out, but at the risk of the lives of the workmen; in other places where the roof and sill are both good, the 'props' or 'setts' may be knocked out and the roof allowed to fall and fill up the space from which the coal has been extracted. Again the great demand for wood has enhanced the price so much, that in several mines near Liège inferior sorts have been employed, such as elder, willow, Canadian poplar, and the consequence of which has been that serious accidents have occurred from the rapid decay to which these species are subject in moist or damp places, such as the workings of a mine. The principal supply of timber for these purposes is obtained from the forests of Luxembourg, to which access may be obtained from the Meuse, the Samoy, and other tributary streams; the price of the timber is as great or greater than in England."

ENGINEERING DIFFICULTIES—EXPERIENCE NOT ALWAYS TO BE DEPENDED UPON.

The first class consists of difficulties with which a professional man meets in consequence of physical circumstances, whether geological or otherwise; and the means by which he succeeds, or, at all events, endea-

vours to get the better of those difficulties. The value of the general diffusion of a knowledge of such difficulties encountered in situations of all descriptions, will readily be appreciated when it is considered that the geological structure, the atmospheric influence, the set and action of the tides, and an almost endless variety of other matters, differ so greatly in different parts of the British islands, that one who has executed a public work in the very best style in one district may entirely fail if called upon to execute a similar work in another. Indeed the chance of failure, in the case of a man of successful experience in one kind of district, is apt to be greater in a different district than if he were without such experience. This is strictly true as a general principle; and yet it is a truth of which many lose sight. The maxim upon which the value of experience is grounded, is limited to identity of circumstances; and, if this is not attended to, the mere experience, the mere fact of having done a similar work before, has more tendency to mislead than to guide to what is right. Besides this, there is a strong tendency in every man to convert his experience into a habit, which habit he is apt to follow in a sort of mechanical way, without giving himself the trouble of the necessary experience. Of this we may mention one striking instance, adding that observation will show that this has been followed by many minor ones. The engineer who planned the railroad between Liverpool and Manchester, and who had not then any practical experience in the construction of a work of the kind, succeeded very well, both in executing and estimating the cuttings through the strata; because from their geological character these strata have no great tendency to imbibe water, expand with the frost, and slip. In the case of Chat Moss, he was a little more out, both in his estimate and in the execution, because the workings in the coal measures tended more to mislead than to guide him in the spongy matters which he had to encounter in the moss. When, however, his attention was directed to the London and Birmingham line, great part of which passes over strata very different from the coal measures, and even from Chat Moss, he was sadly thrown out of his estimates, and in many places the first workings were little else than a series of failures. The estimated expense, even when amended by the addition of 50 per cent., did not amount to above one-fourth of what has been actually expended already; and, yet, the line will be in many places a source of *great expense for* years to come. This is *but one instance*, though a very striking *one; but there is* scarcely a railroad of any length upon which something similar has not occurred, and that too upon those which are of the most recent construction. Now, if the difficulty had been publicly stated as soon as it occurred, the statement would have led to the investigation of it by scientific men generally, and the natural result would have been, that it would have been much less serious in itself, and would not have occurred again in other instances. It is distinctly to be understood that no professional man, however eminent he may be, or however jealous of his reputation, ought to consider this as any confession of inferiority. Engineers, and gentlemen of the collateral professions, are not endowed with the gift of foreknowledge any more than other men; and, therefore, they would show their greatness, and their zeal for their own professional superiority, and the interest of their employers, far more by stating the embarrassments of a perfectly new case, which are common and necessary to all men, than by concealing them, and buying experience at far more cost, to themselves or to others, than it is really worth.

The very great importance of this class of difficulties, and the consequent obligation upon professional gentlemen to provide against them by every possible means, are so very great that we may venture to name, and only to name, one or two more in other departments. Harbours, and their requisite docks, claim a forward place in this class of difficulties; the more so that in some of them the difficulty is not to be got the better of by any means. Of harbours, Ramsgate is a conspicuous instance, and should serve as a warning not to attempt costly works of this kind in situations where the sea is invading the land; and yet it is reported that what has failed at Ramsgate is to be tried at Margate, where failure will be just as certain. Drifting shingle is also an untoward matter to deal with, of which the harbour at Dover forms a striking instance. Wet docks, and graving docks with shallow foundations on plastic clay or sand, are also very unwise attempts; and though there are many instances of failure in them, we are not aware of one of success. The characters of rivers, too, are very important elements in bridge building; and a professional man who has erected a permanent bridge on a slow flowing river, or one which has its mountain affluence regulated by lakes, is very apt to make a very insecure structure, if he attempts to construct a bridge with piers in the bed of a rapid river which has no regulators, even though the bases of those piers should be without the bed of the river during the dry season. Some remarkable instances of this have occurred on various rivers in Scotland,

and in the mountainous parts of Wales, at least such of them as are subject to seasonal heavy falls of rain.

The second class of cautions to which we shall advert, are those which respect the safety of the people employed. The Engineer ought to be well acquainted with the nature of his ground, his foundations, and his means of temporary support; because the failure of any one of these may be productive of the most disastrous consequences. This is especially necessary in driving tunnels through the chalk, where it begins to be overlaid by the tertiary strata. Where these meet, there has almost invariably been violent action, by which the chalk has been worked into pits, apparently by the action of the gravel, while rolling in water; and these pits are sometimes very treacherous, inasmuch as fresh portions of chalk may be filled in over the gravel, and conceal the danger. Very disastrous consequences resulted from this in driving the Kilsby tunnel, on the London and Birmingham line; the boring, which, from ignorance of the treacherous character of such grounds, were not made near enough to each other, all showed uninterrupted chalk to the very bottom of the intended excavation. But one of the shafts, or the tunnel, or both, had been driven so near to the lower part of one of the concealed masses of loose gravel, that its support gave way, and the whole contents of the chamber were instantly precipitated into the tunnel and shaft, destroying the workmen in the most summary manner, and occasioning no small pecuniary loss. This is but o e instance out of many; but, as we shall have frequent occasion to revert to the subject, we shall not notice any others. In the mean time we must add, that if lives are sacrificed through ignorance on the part of those who ought to know the nature of all the materials, the parties thus ignorant are highly criminal.—(From *The Surveyor, &c.*, a New Monthly Scientific Periodical.)

REMARKS ON M. ARAGO'S ESSAY ON MACHINERY, IN REFERENCE TO THE PROSPERITY OF THE WORKING CLASSES.

Sir,—M. Arago, whose essay on machinery, in connection with the prosperity of the working classes, appeared in one of your recent numbers, might have spared himself the trouble of acknowledging that for most of his materials he was indebted *to the publications of Lord Brougham and his friends. It needs but a cursory* inspection to convince any reader that, for nine-tenths of his arguments, and the facts by which they are supported, he has had recourse to the shilling pamphlet of the Useful Knowledge Society, called "The Rights of Industry," sent forth with a view to check the anti-machinery agitation in 1830. It would have been quite as well had M. Arago restrained himself from travelling, even an inch, "beyond the record." This would have saved him, probably, from the smile produced in English readers, at the expense of his Gallic veracity, when he drags himself from statistical details, to determine at once "the *essential merits* of the question." How? By the lights thrown from the Heathen mythology! It may be very true that "it was among the gods that were placed the inventors of the spade, the sickle, and the plough; but minds of a John Bull cast can scarcely admit the *conclusive* effect of the fact on the question under discussion.

In another wandering from his original, M. Arago is equally unfortunate. He is ridiculing, without mercy, those strange people who affect to perceive an appreciable difference between the distaff and the power-loom, a steam-engine and a spade; and goes on to observe, "Those labourers were not arrested by this sophistical distinction between tools and machinery, who, seduced by the execrable theories of some of their pretended friends, ran through certain counties of England, in the year 1830, vociferating "*death to machinery!*" Rigorous logicians, they broke the sickle in the farm-yard, destined for reaping; the flail employed in threshing, and the sieve with which the grain was cleaned," &c. Now, unfortunately for himself, M. Arago assumed facts have no foundation in truth. It was, indeed, one of the objects of the little work he has made much use of, to persuade the Kentish labourers that they *ought*, as strict logicians, to do the strange things M. Arago lays to their charge—still stranger to relate, they never took the advice, but went on as before, destroying all the *threshing machines* that came in their way, not only without falling foul of the *flails*, but avowedly for the sake of reinstating "the flail" in its ancient supremacy, in which it is understood they pretty well succeeded. Laying no claim

to the title of "rigorous logicians," caring not a jot for their reputation as philosophers, either at home or abroad, and without settling the essential merits of the question by a reference to the Heathen mythology, or puzzling over the impossibility of drawing a middle line between ploughing by steam and tearing up the ground with their finger-nails, they merely argued from what they could see and feel but too well—that the threshing-machine threw them out of work, and that being out of work they were out of bread. It followed naturally, "Down with the machine—up with the flail!" Such being the case, and the fact being well known in every quarter to which a newspaper of the time could penetrate, what is to be thought of M. Arago's strange perversion of the truth? Is it uncharitable to ascribe it to that superabundant vivacity (too great to allow its owner to wait to verify its suggestions) which boils over in every paragraph of his essay?

M. Arago is, indeed, a strange person to talk of "rigorous logic," while his own lucubration betrays a want of the article to such an enormous extent as to destroy the whole force of his reasoning. Thus his chief proposition is, that the facts he adduces irrefragably prove, that the effect of the introduction of machinery in any department, is to cause an increased demand, to such an extent that, to use his own words (italics and all), "the number of workmen which these employments require, *increases* with the introduction of the means of more rapid fabrication." Such being the case—and M. Arago exhausts all his energies in proving that it ever has been so, and assumes in every line that he *has* proved it triumphantly—it is plain enough that the question as to "the influence of machinery on the prosperity of the working classes," must be considered settled—that it must be uniformly beneficial; and, that those who would obstruct its progress in the slightest degree, must be directly opposed to the well-being of the labouring many. Above all, that those who call for a "tax on machinery," by way of moderating its supposed potency in competing with human hands, must be *exceedingly* weak-minded, or *exceedingly ignorant.* Nothing short of this *will do; for,* as M. Arago observes, "Political economy has now happily taken its place among the sciences of obscuration," and the conclusions it leads to cannot therefore be resisted by any dispassionate man in his sober senses,

Now, then, for a display of "strict logic"! After all this—after all the time and trouble taken in elucidating this grand point, how does M. Arago conclude? By informing us that when new improvements are introduced, "certain classes of workmen suffer from the change"!—that "their honourable and laborious industry is annihilated at a blow"!—that "those who are the most expert and deserving are *thrown out of employment*, and *can but rarely find other means of subsistence*"!!!—and by lamenting that, "*these reflections are just, and that the melancholy consequences to which they refer, must frequently occur*"!!

Need more space be occupied in quoting from this demonstrator of the constant fact, that machinery *increases* manual employment; or is this specimen of the consistency of his reasoning sufficient? It may, perhaps, be worth while to cap the climax, by copying the energetic sentences in which he tells us, that "humanity demands as a duty, sound policy dictates, sad events not yet forgotten strongly recommend"—what? the *taxing of machinery* for "the opening of spacious workshops, in which the workmen deprived of employment" (by that power which invariably makes employment more abundant!), "might for a time find occupation suitable to their power and intelligence"!! O for the rigorous logic of a French Academician!

Your's respectfully,

H.

London, Feb. 12, 1840.

MODES OF MAKING BRASS AND OTHER YELLOW ALLOYS OF METALS.*

Brass was formerly manufactured by cementing granulated copper, called *bean-shot*, or copper clippings, with calcined calamine (native carbonate of zinc) and charcoal, in a crucible, and exposing them to bright ignition. Three parts of copper were used for three of calamine and two of charcoal. The zinc reduced to the metallic state by the

* See description of Fontainemoreau's New Alloys, vol. 31, p. 162; and Cutler' New Alloys, present vol. p. 237.

agency of the charcoal, combined with the copper, into an alloy which formed, on cooling, a lump at the bottom of the crucible. Several of these, being remelted and cast into moulds, constituted ingots of brass for the market. James Emerson obtained a patent, in 1781, for making brass by the direct fusion of its two metallic elements, and it is now usually manufactured in this way.

It appears that the best proportion of the constituents to form fine brass is one prime equivalent of copper $= 63\frac{1}{3} +$ one of zinc $=$ 32·3; or very nearly 2 parts of copper to 1 of zinc. The bright gold coloured alloy, called Prince's, or Prince Rupert's metal, in this country, consists apparently of two primes of zinc to one of copper, or of nearly equal parts of each. Bruss, or hard solder, consists of two parts of brass and one of zinc melted together, to which a little tin is occasionally added; but when the solder must be very strong, as for brass tubes that are to undergo drawing, two thirds of a part of zinc are used for two parts of brass. Mosaic gold, according to the specification of Parker and Hamilton's patent consists of 100 parts of copper, and from 52 to 55 of zinc; which is no atomic proportion. Bath metal is said to consist of 32 parts of brass and 9 parts of zinc.

The button manufacturers of Birmingham make their *platin* with 8 parts of brass and 5 of zinc; but their cheap buttons with an alloy of copper, tin, zinc and lead.

Red brass, the Tombak of some, (not of the Chinese, for this is white copper,) consists of more copper and less zinc than go to the composition of brass; being from $2\frac{1}{2}$ to 8 or 10 of the former to 1 of the latter. At the famous brass works of Hegermühl, to be presently described, 11 parts of copper are alloyed with 2 of zinc into a red brass, from which plates are made that are afterwards rolled into sheets. From such an alloy the Dutch foil, as it is called, is manufactured at Nürnberg; Pinchbeck, Similor, Mannheim gold, are merely different names of alloy similar to Prince's metal. The last consists of 3 of copper and 1 of zinc, separately melted, and suddenly incorporated by stirring. — *Wiegleb.*

In the process of alloying two metals of such different fusibilities as copper and zinc, a considerable waste of the latter metal by the combustion, to which it is so prone, might be expected; but, in reality, their mutual affinities seem to prevent the loss, in a great measure, by the speedy absorption of the zinc into the substance of the copper. Indeed, copper plates and rods are often *brassed* externally by exposure, at a high temperature, to the *fumes of zinc, and afterwards laminated or drawn.* The spurious gold wire of Lyons is made from such rods. Copper vessels may be superficially converted into brass by boiling them in dilute muriatic acid, containing some wine-stone and zinc amalgam.

The first step in making brass is to plunge slips of copper into melted zinc till an alloy of somewhat difficult fusion be formed, to raise the heat, and add the remaining proportion of the copper.

The brass of the first fusion is broken to pieces, and melted with a fresh quantity of zinc, to obtain the finished brass. Each melting takes about 8 or 9 hours. The metal is now cast into plates, about 40 inches long by 26 inches broad, and from one third to one half inch thick. The moulds are, in this case also, slabs of granite mounted in an iron frame. Granite appears to be preferred to every thing else as a mould, because it preserves the heat long, and by the asperities of its surface, it keeps hold of the clay lute applied to secure the joinings.

The cast plates are most usually rolled into sheets. For this purpose they are cut into ribands of various breadth, commonly about $6\frac{1}{2}$ inches. The cylinders of the brass rolling-press are generally 46 inches long, and 18 inches in diameter. The ribands are first of all passed cold through the cylinders; but the brass soon becomes too hard to laminate. It is then annealed in a furnace, and, after cooling, is passed afresh through a rolling press. After paring off the chipped edges, the sheets are laminated two at a time: and if they are to be made very thin, even eight plates are passed through together. The brass in these operations must be annealed 7 or 8 times before the sheet arrives at the required thinness.

The French writers affirm, that a brass, containing 2 *per cent.* of lead, works more freely in the turning lathe, but does not hammer so well as the mere alloy of copper and zinc.

At the brass manufactory of Hegermühl, upon the Finon canal near Potsdam, the following are the materials of one charge; 41 pounds of old brass, 55 pounds refined copper (gahrkupfer) granulated; and 24 pounds of zinc. This mixture, weighing 120 pounds, is distributed into four crucibles, and fused in a wind furnace with pit-coal fuel. The waste varies from $2\frac{1}{2}$ to 4 lbs. upon the whole.—*Ure's Dict. of Arts, &c.*

NOTES AND NOTICES.

Norwich—a—Port.—The works of Norwich and Lowestoft Navigation were put up for sale according to advertisement, at Garroway's, on the 28th of January, and knocked down at no more than 14,000*l*. The newspapers do not say who was the purchaser—whether the works have fallen into private hands, or have been resumed—through the medium of the

auction—by their original proprietors. Perhaps Mr. Thorold could favour us with some *authentic* information on this point, having all the advantages of a residence on the spot?

Espy's Theory of Thunder Anticipated.—Sir,—Your correspondent, who, in your number 854, p. 208, has detected the want of novelty in Espy's "New Theory of Rain," might have said the same thing of Espy's equally new theory of thunder; since both these theories had been given together as parts of one scheme almost eleven years ago by Mr. Meikle, in the before cited *Quarterly Journal of Science*, for April, 1829; and both have also been published in the Hygrometry of the Encyclopedia Britannica—FULMEN. Glasgow, Feb. 7, 1840.

Converting Stone into Marble.—A discovery is said to have been recently made in Russia, of a method whereby the softest stones may be hardened, and have communicated to them the beauty, solidity, and even colours, of the rarest marbles.—*Athenæum.*

Printing Paintings.—The Berlin Correspondent of the *Athenæum* adverted lately to the discovery of Herr Liepmann by which an unlimited number of fac-similes of ancient pictures can be produced at a very trifling price. I have since heard of a M. Krewel, a painter at Bonn, who is said to have been engaged for many years in making experiments on Lithochromy, or stone painting, by means of which copies of original oil paintings have been produced by the customary mode of impression. This discovery is described as particularly calculated for copying pictures of the old German school, and M. Krewel has found it to succeed remarkably in portraits. Several of these lithochromic pictures have already appeared—I have been particularly struck with one—The Saint John, known already by Müller's copper-plate engraving. The impression is taken on linen, and has absolutely the appearance of a painting. The drapery, both in colour and folds, leaves nothing to be desired."

The Arts applied to Manufactures.—Let us fancy that, some thousand years ago, a mortal, wandering through an oriental wood, saw a worm falling from a fruit-bearing tree—that he found this little creature had reached the end of one of its stages of existence, and was laboriously engaged in shrouding itself in an unknown substance, like a fine thread of gold, out of which it constructed its tomb; that, attracted by the circumstance, he found this shroud to consist of a thread hundreds of yards long, which a very little attention enabled him to detach; he found he could strengthen the threads by uniting them together, and they could be applied to various purposes of usefulness; he thought of winding off the thread; the reel lends him the first assistance, but he could not make the reel without the co-operation of a knife, or some such instrument with a sharp edge. Thus the aid of art—of the produce of art, is already called in. With this rude instrument he makes a machine as rude, which reels off the thread coffin of the curious animal. In process of time, he finds that this fine filament can be applied to the making of garments—garments alike useful and ornamental. Now trace the progress of things by which, from the narrow sphere of his observation and experiment, his success spreads through the districts he inhabits, and from them to other lands, and becomes an object of importance to communicate with the whole family of man. By and by the cocoon, or the produce of the cocoon, finds its way to foreign countries, probably more intelligent than his own, again to be operated on by a higher intelligence and more practised skill. This associates the thread of the silk-worm with a ship, with ship-building, and all its marvellous combinations.—Some wandering merchant probably conveyed the raw material to Persia; some adventurous mariner to Greece or Italy, or other regions where the raw material gave a new impulse to science and to thought. But consider for a moment, before the ship was launched upon the water, how many elements were necessary for its production; think of how multitudinous and how various the materials which that ship required for its construction, before the products of that remote country are brought to their ultimate markets for manufacture. I refer to this particular topic because it is associated with the prosperity of the districts in which we are, and I wished to carry back your thoughts to the germ whence that prosperity sprung.—*Bowring's Lecture at the Poplar Institution.*

Bursting of Steam Boilers.—Mr. Murray, in a lecture at the Mechanics' Institution, Birmingham, stated that the fearfully fatal cases of the *Earl Grey* steamer at Greenock, and the *Union* at Hull, had directed his particular attention to the enquiry as to the causes of these deplorable events. He differed entirely from the diversified solutions of the problem that had been given to the public; and ventured to state his individual opinion, as deduced from experiments, merely that it might be the means of affording some useful hints on a subject so deeply interesting and important to the community. Safety valves, he observed, (as they were called,) were merely a *misnomer*, and in the sudden extrication of a volume of highly elastic steam could be of little avail, while they afforded no adequate relief. There should, he believed, be always *two* safety valves. He mentioned a case where one of the valves of a boiler thus supplied acted freely, and the other was *gagged*. The latter phenomenon he did not think depended entirely on the ordinary pressure of the atmosphere, but had to do with some other principle; in proof of this, he cited the instance of a transatlantic steamer, where the *safety valve* was gagged, requiring the purchase of a crow bar to raise it, after the entire weights had been previously removed. Mr. Murray also considered that safety valves were much too contracted in their dimensions, and two safety valves would provide against the contingency referred to. The bursting of steam boilers was considered attributable to the sudden disengagement of highly elastic vapour or steam from the individual spot of the boiler against which a burst of flame might impinge; this might detach a portion of the calcareous incrustation at the bottom, and this extricated steam would dart like an arrow through the water, and strike that portion of the dome of the boiler immediately opposed. The *comparatively non-conduction*, or *slow conductibility* of the *water*, would not allow the suddenly evolved vapour to diffuse or expand, and thus press equally on the vault of the boiler: the safety valve in such an emergency would be useless, and he contended that the appearance of the roofs of the boilers thus destroyed entirely corroborated these views. In proof of his assertions, Mr. Murray referred to the *varied* temperatures that might be observed in a vessel of hot water; there was one temperature at the top, another in the centre, and another at the bottom, while there were others in various directions laterally. This was particularly remarkable when a piece of ice was dropped into a tumbler of water. Various substances modify ebullition, such as a chip of wood in the case of æther, and might suggest important and useful hints. In a glass vessel of water, where the flame impinged, the ebullition was consequently *per saltum*, and unequal; while a few metallic filings served the purpose of facilitating an equal diffusion and extrication of vapour. Mr. Murray considered that the *prevention* of these accidents was as obvious as the application was easy—namely, the diffusion through the water in the steam boiler of *copper wire*.—*Midland Counties Herald.*

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CURTIS'S PATENT HYDROSTATIC JACK.

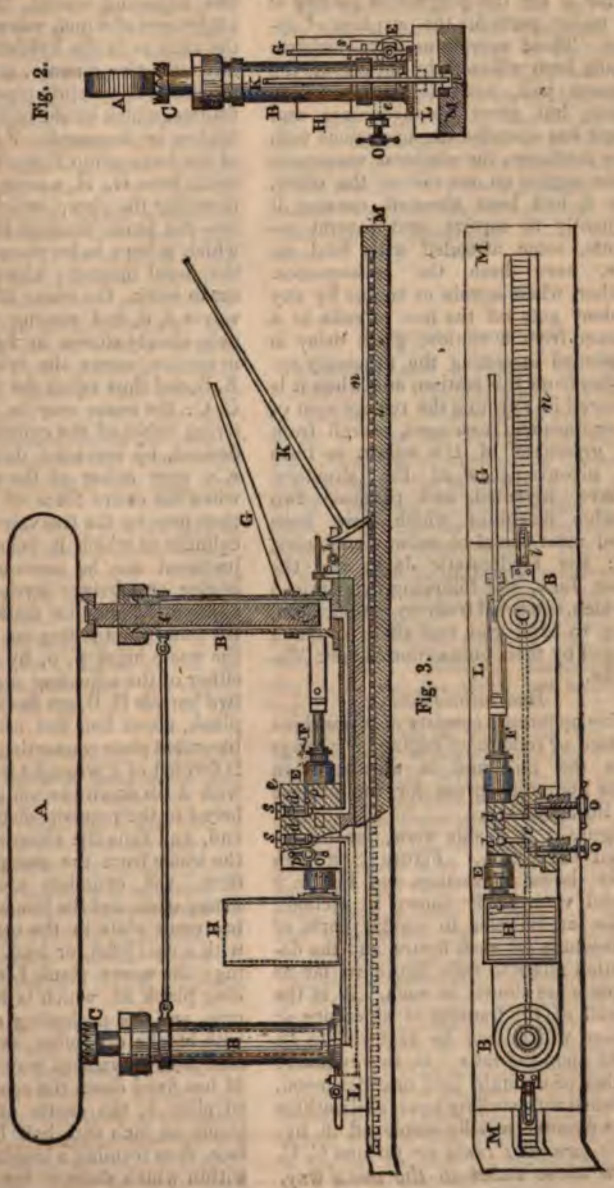


Fig. 1. Fig. 2. Fig. 3.

CURTIS'S PATENT HYDROSTATIC AND SCREW JACKS.

Sir,—Frequent occasion exists in the working of railways to move the ponderous engine from one line of rails to another, to lift it on to, or off from the line, or to elevate it for the purpose of getting at the under parts for the purposes of repairs. These operations have hitherto usually been effected by means of the common jack, assisted by ropes and pullies, but great inconvenience and danger has attended the operations with these machines, the slightest movement of the engine on one side or the other, after it had been elevated, causing it frequently to capsize, and several accidents, some attended with fatal results, have been the consequence. Further, when a train or engine by any accident gets off the line of rails at a distance from a station, great delay is occasioned in getting the necessary apparatus from the station, and when it is procured in effecting the replacement of the engines and carriages, as well from the greatness of the weight as from the inconvenience of the situation. I have invented and patented two portable machines which have been found most useful to railway engineers, viz,: the Hydrostatic Jack, and the Screw Jack, the following descriptions of which, extracted from my specification, I beg to hand you, and shall be much obliged by their publication in your Magazine.

Hydrostatic Jack.

This apparatus consists of a machine to place or replace an engine or carriage upon the rail, and is an adaptation of the hydraulic press for the purpose of a lifting jack.

Figure 1 is a side view, one half is shown in section. Figure 3 a plan partly shown in section, and Figure 2 an end view partly shown in section; similar letters refer to similar parts of the machine in each figure, and the description refers to each figure so far as the parts are shown in each. A is the end rail of the framing of an engine or carriage which may be required to be placed upon the rails. B, two cylinders or tubes of wrought iron or other metal, furnished with stuffing boxes and leathers in the manner usually employed in hydraulic presses; rams or pistons C, C, work in these tubes in the usual way, and the upper ends of the rams are provided with notched ends or otherwise as may be found convenient. E is a force pump fixed horizontally upon the plank L; *e* is a metal block in which the channels are formed for the channels, valves, and adjusting screws, the general arrangement of which valves and screws is the same as in the hydraulic press, but I form it in this manner, in order to avoid the use of connecting pipes and the usual fittings, which would be very liable to be broken or deranged. F is the plunger of the force pump E, worked by the bell-crank lever G. H, a cistern to hold water to supply the pump, which is introduced into the pump through the lying valve, which is kept in its place by a spring in the usual manner; when the pump is set to work, the water lifts the vertical valves *d, d*, and passing through channels clearly shown in figures 1 and 2 in section, enters the cylinders or tubes B, B, and thus raises the rams or pistons C, C; the water may be prevented entering either of the cylinders, as may be desired, by screwing down the screws *s, s*, over either of the vertical valves, when the entire force of the pump will then pass by the free valve and enter the cylinder to which it belongs. This adjustment may be necessary to keep the engine or carriage level, and the same adjustment may be made by stopping the pump, and letting out the water from the waste holes *p, p*, by screwing back either of the adjusting screws *o, o*; the two barrels B, B, are fixed upon a strong plank, about four feet asunder, and the basement plate connecting them together is formed of a wrought iron plate rolled with a rib down the middle; this rib is bored to the requisite distance from each end, and thus the channel is formed for the water from the pump to the cylinders; the cylinders are formed with flange ends, and the joints made with the basement plate in the usual way, either with a rust joint, or lead, or other jointing; the upper plank L slides upon the long plank M, which is laid across the rails, and the projecting end supported with blocks of timber, or in any other readyand convenient manner; the plank M has fixed down the centre, the notched plate *n*, the centre of which sinks about an inch and half below the surface, thus forming a longitudinal groove, within which slides a bar of iron fixed

to the under side of the plank L; thus the upper plank L is steadied and cannot get out of position. When the engine or carriage is lifted, the bar K is hooked into the link *i*, and the toe of the bar inserted into one of the notches of the plate *n*; then a man, bearing down the end of the bar, drags the apparatus and engine or carriage towards him, the whole sliding upon the plank M. When the engine or carriage is adjusted over the rails, the adjusting screws are screwed back, and the water escapes through the waste holes *p, p*, when the rams descending, the engine or carriage is placed upon the rails; this object being effected, the water is thrown out of the cistern H, and the apparatus placed in the tender or other place provided for it; in some cases, a single cylinder and ram may be employed with a vertical pump, and for other purposes besides that described, likewise the cylinders may be substituted by screws, the other general arrangements being the same; also pipes or fittings for the water channels in any other suitable way than that shown.

One of the machines may be seen at work (at the manufactory, John's-place, Holland-street, Blackfriars'-bridge), loaded with a weight of 8 tons, which is lifted one foot high by the force of one man in three minutes; thus the worst accident may be set to rights in half an hour by four men, although the engine may be buried in the soil up to the axles.

I prefer the hydrostatic apparatus from having observed that, when one pair of wheels of an engine or carriage is off the line, when the end is lifted by a jack in the ordinary way, the vibration produced in the act of turning the screw has frequently a tendency to throw the engine or carriage farther off the line; the hydrostatic apparatus, by producing a steady motion upwards, produces no vibration, and it is consequently safer.

In most cases, an accident happens either upon the edge of an embankment or on the side of a cutting, under which circumstances it would be exceedingly difficult to use a screw at all, as the space would be too confined to work it; but the hydrostatic apparatus can be pushed under the engine, either or both rams may be forced upwards, so that, in the case of the engine and tender being both off the line together, either may be got on the line, without reference to the other, and with the greatest facility.

The modification with the screw is a very simple and portable apparatus, and should be always carried in the tender, is perfectly adapted for a slight accident, but is not so perfect in its application as the more expensive hydrostatic apparatus. I recommend that a hydrostatic apparatus be kept at each station, so that in the event of a serious accident happening to a train, the most efficient apparatus may be dispatched to its assistance.

Traversing Screw-Jack.

Figures 4 and 5 exhibit the screw modification. The screw-jack *a* is bolted to the plank *c*; at the other end of the plank is fixed the rack *g*, in which the toe of the strut *f* advances as the screw *b* is elevated; the strut works in a joint in the follower *k*; the position of the strut when the screw is depressed is shown by the dotted lines. The object of this strut is to relieve the screw of the violent cross strain to which the apparatus is subject, when the engine or carriage is pulled over by the lever; which strain is entirely transferred to the strut, and the screw has merely to carry the load.

The operation of traversing the jack is as follows: by hooking the link *i* upon the hook of the lever *e*, the toe of the lever being inserted into a ratch of the rack *h* of the lower plank, when a man, bearing down the end of the lever, drags the apparatus and engine or carriage towards him with great facility; the same lever is used to turn the screw, and to produce the traverse motion. By this apparatus an engine of 16 tons weight has been replaced upon the rails in five minutes by the engineer and stoker alone; thus those delays which are the subject of so much annoyance and loss to railway proprietors and the public, need not happen in future; the apparatus is exceedingly portable and cheap, and no train ought to be allowed to go out without its being sent along with it; it may be carried either upon

Fig. 4.

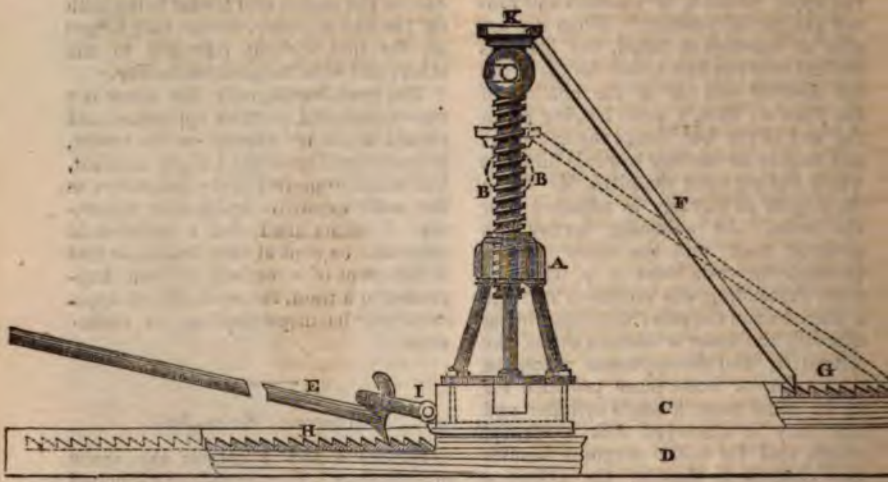
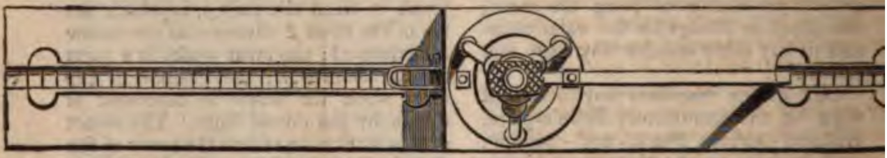


Fig. 5.



the tender, or upon some other place which may be selected for it.

I am, Sir, &c.

W. J. Curtis.

15, Stamford-street, Blackfriar's Road.

CURTIS'S PATENT RAILWAY SIGNALS.

Sir,–A subject of great interest amongst railway engineers at the present moment is the best means of working the Greenwich Railway free from chance of accident by collision, in consequence of the Croydon train crossing the Greenwich rails, and the expectation of the Brighton and Dover trains coming upon the Greenwich line. The matter is now undergoing investigation before a Select Committee of the House of Commons, and many plans have been laid before them, and more are in the course of preparation to submit to their judgment. One of these is invented and patented by me, and I beg to hand you a description thereof for publication.

The peculiarity of my plan consists *in conveying* the signal a mile or any *convenient* distance from the station, the object being that the engineer may pass the signal post, and have distance and time sufficient to stop the train before reaching the station or place for stopping; the machine for a light is shown in figure 1. A, is a lamp post. C, a lantern of any peculiar shape, with bulls-eyes on three sides, or it may be formed of glass like a street-lamp, or in any other manner. C, is the lamp with reflectors behind the light in the usual way. B, is a shade supported upon the vertical rod *e*, passing through the post and united by a joint at its lower end, with the bell-crank F, to which is likewise suspended the ball or weight M; to the other end of the crank F, a joint is attached, with which is connected a strong wire *g*, which is led like a bell-wire, by proper

ections to the crab h, placed in n of, or near, the station-house; the or a chain or rope united to its end tened to the barrel i, of the crab h, coils round the barrel—then when n turns round the handle k, by s of the pinion fixed on the handle and the barrel wheel denoted by ircle n; the barrel i is turned l, and the chain, or rope, or wire, lled round the barrel, the wire in, and the crank F made to y the place shown by the dotted vhen the vertical rod e, and shade raised, and the light concealed. counterbalance M is employed to the connecting wire g always hed; in places where gas is em-d, a large gas burner may be sub-ed for the lamp, and the rod e, to communicate with a stop cock, t by raising or depressing the rod as may be turned on or off. A concealed jet of gas may be always ng so as to inflame the larger jet the rod is raised by the apparatus, powerful light may be used when d, and when not required the gas ot be wasted. The apparatus as is a night signal, or to be used the weather is so dark that other s cannot be seen; but for a day it is merely necessary to employ , so as to raise a vane or vanes telegraph, a spar for example at the top of the lantern; when it is required to use the telegraph, a man may make the necessary and self-evident connexion between the rod e, and the limb of the telegraph, which limb being

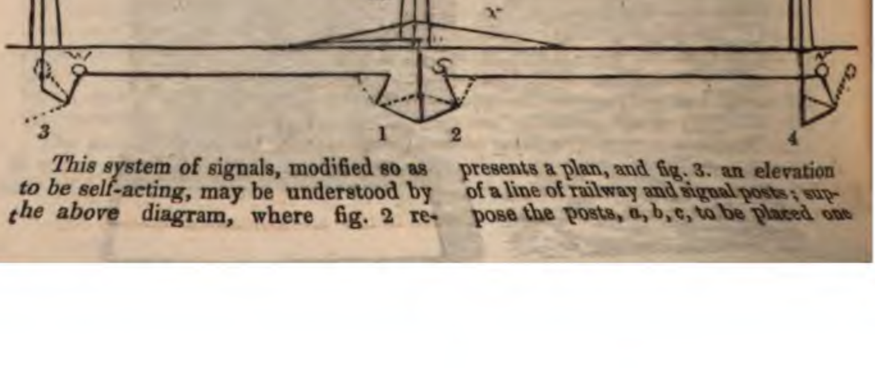
Fig. 1.

made with a bell-crank, when the rod *e* is raised may cause the telegraph limb to lie horizontally, and when the rod *e* is depressed to stand vertically, or the apparatus may be formed double so as to work both telegraph and the lamp at once, whether by day or night.

The best arrangement of this method of signals will be to place them at the same distance asunder as the police are stationed, and instead of making the usual sign of a flag upon the passage of a train, they should convey the notice of its approach to the next policeman in advance, which would advise him to look out that switches, points, and every thing besides are right. In the case of an accident, these signals may be conveyed from one policeman to the other with great rapidity, a signal can be conveyed a mile in 15 seconds, allowing the same time for delay at the next station, thus advice will be conveyed 100 miles in 50 minutes, so advising the detention of the train from whatever cause. By employing 4 wires, as many distinct signals may be used as the necessities of railway travelling require; to vary the signals it will be necessary merely to detach from the crab one wire and attach another, connected with a different limb of the telegraph &c. For advising the advance of a train, a bell or alarum would be the best, which would ring both when the crab was wound up and by the reaction of the weight when the crab was unwound, the winding up might indicate that the train was in sight, and the unwinding that it had passed the last signal post, thus the policeman in advance would be aware of the distance of the train; but these details may be varied indefinitely. Likewise by a self-evident modification of this apparatus the engine can be made to communicate its own approach.

Fig. 2.

Fig. 3.



This system of signals, modified so as to be self-acting, may be understood by the above diagram, where fig. 2 represents a plan, and fig. 3. an elevation of a line of railway and signal posts; suppose the posts, *a*, *b*, *c*, to be placed one

asunder, and that the posts n m on ther side of the line are placed at distances, and intermediately with first. The engine in passing a is to open or show the signal at b; riving at b, to shut a and open c, so on; so that it exhibits the signal le before it, and a mile behind it. a second train must on no account a whilst the signal remains; or the train passing b shuts it off. he distance of a mile is performed given time, say three minutes, if an ie on arriving at a, and after wait- or going very slowly, the signal not shut-off, the engine-man must ume that either some permanent of detention has happened on the or that the apparatus is deranged; ither case he must go on very ously until he arrives at the next l post.

ie mode of working is shown in 3. Bell cranks are placed as before ined, which act upon the shade or raph; at b are placed two bell ks, or other apparatus, from which are connected with a and c; thus, the engine E arrives at b, it de- es the bell cranks 1, 2, and through aedium of the wires, the bell cranks d 4 are brought into the position shown, closing a and opening c at the same operation. The engine, upon reaching c, effects a like operation upon b and another signal further on, and so on; the reverse position of the apparatus is shown by the dotted lines. It will be observed in the drawing that the shades are represented below the lights; to meet the case of an engine running the reverse way, on the same line of rails, the apparatus must be so arranged that the engine would depress the lever x, which would produce a stroke of double the length, and cause the shade of a to rise *above* the light, so that this difference would be quite intelligible. The apparatus must be likewise so arranged that it can be acted upon by hand, or by the engine, as may be required, the best way will be to fix a tappet upon the frame of the engine, upon one side, say the right hand, so that when the engine runs one way, it acts upon the lever at E, and the other way upon the lever x, the signals n, m, *et cetera* upon the opposite line of rails, act of course in a similar way. There will be no very great expense of oil for the lamps if oil be employed, as the wicks can be depressed, as has been before observed for gas signals.

W. J. CURTIS.

15, Stamford Street, Blackfriars Road.

LONDON FIRES IN 1839.

Shrill sounds of danger wake the dead of night,
The well known Rattle pierces slumbers light,
'Tis *fire* or *thieves* Policemen's care decries:
From various tongues loud cries of "Fire" arise.
The signal soon from various beats has brought
Assistance to the spot with danger fraught;
The affrighted inmates roused from soundest sleep,
Find flaming barriers cut off their retreat.
In tearful agony relief they crave,
And pray for rescue from a fiery grave.
Their piteous prayers are turned to hopeful praise,
When from below they lengths of ladders raise.
As one by one the several lengths are joined,
A certainty of rescue thus they find,
And safe descending, loud their thanks express,
For opportune deliverance from distress.
Scarce this achieved when engines quick arrive,
And with the flames courageous firemen strive:
Advancing Branch-men onward press unshaken,
Till floor by floor is from the fire taken.
The contest 's short, the flames soon quit their hold
Before the "hydraulic skill," of London firemen bold.

ie close of *another year brings me before your readers as the annual ian of London Fires, and although* happily I have no stirring details of the burning of a Royal Exchange—and thanks to the *vis inertia* of bodies cor-

porate and incorporate, we are "insured" against such a calamity for some years to come—neither has the past year witnessed the destruction of a "Fenning's" or a "Davis's Wharf;" nevertheless, the number of metropolitan fires in the year just ended, is the largest that has occurred since the formation of the London Fire Establishment in January, 1833.

Of the character and consequences of these fires I shall speak hereafter, at present I beg to submit the following tabular epitome of their numbers and classification, observing *en passant*, that the list of fatal fires has been augmented to an unusual extent by several calamities of a very peculiar and distressing nature, which have occasioned a most unparalleled sacrifice of human life.

MONTHS.	Number of Fires.	Number of Fatal Fires.	Number of Lives Lost.	Alarms from Chimneys on Fires.	False Alarms.
January	48	0	0	5	5
February	46	0	0	14	9
March	41	2	3	9	4
April	46	0	0	7	2
May	50	3	6	6	4
June	45	2	2	8	8
July	42	1	1	3	3
August	59	0	0	14	7
September	44	1	1	8	6
October	51	0	0	9	7
November	53	4	18	8	6
December	59	1	1	13	9
Total	584	14	32	101	70

The number of fires wherein the premises were totally destroyed is 17
Very seriously damaged 165
Slightly damaged 402
Alarms which proved to be occasioned by chimnies on fire. 101
False alarms originating in error or design 70

Making the total number of *calls* the same as last year 755

The number of instances in which insurance had been effected on the building and contents was 169
On the *Building* only 58
On the *Contents* only 115
Neither insured 242

584

The following analytical table of London fires for the past seven years, during which the London Fire Engine Establishment have been in operation, shows at a glance the fluctuations that have taken place from year to year in these matters.

Year.	Totally Destroyed.	Seriously Damaged.	Slightly Damaged.	Total Number of Fires.	Alarms from Chimnies on Fire.	False Alarms.	Total of Alarms.	Total of Fires and Alarms.
1833	31	135	292	458	75	59	134	592
1834	28	116	338	482	112	57	169	651
1835	31	125	315	471	106	66	172	643
1836	33	134	397	564	126	66	192	756
1837	22	122	357	501	134	82	216	717
1838	33	154	381	568	108	79	187	755
1839	17	165	402	584	101	70	171	755
Average.	28	136	354	518	109	68	177	695

be seen that by a most singular
ice, the total number of *calls*
and 1839 are the same, in the
ar the number of fires being
ibly above the usual average,
e alarms were below it. The
iumber of false alarms this year
n traced to reasonable grounds,
n for the most part to have
d in the pardonable anxiety of
persons to prevent mischievous
nces. The atmospheric pheno-
the past year have been some-
nty; on the 3d of September,
a splendid *aurora* took place,
heavens presented one of the
agnificent specimens of those
nary phenomena, the falling
northern lights, ever witnessed
titude. The first indication of
ilar phenomena was about half-
o'clock in the evening, when
imson, apparently vapour, rose
northern portion of the hemi-
i rays, and gradually extended
itre of the heavens, and by ten
or a quarter past, the whole,
to west, was one vast sheet of
coloured light. It had a most
appearance, and was exactly
occasioned by a terrific fire.
t varied considerably; at one
emed to fall, and directly after-
se again with increased bright-
here were seen to be mingled
olumes of smoke which rolled
over, and most of the spectators
inced that it was "a tremen-
flagration." The consternation
s parts of the metropolis was
it, and thousands of persons
running in the direction of the
fire. The engines from the
de stations in Baker-street,
on-street, Watling-street, and
her stations, were horsed and
off towards the supposed "scene
tion" with more than ordinary
ollowed by carriages, horsemen
strians. Some of the engines
l nearly as far as Highgate and
before the error was discover-
e appearances lasted upwards
urs, and as morning approach-
pectacle became one of more
At two o'clock the pheno-
esented a most gorgeous scene,
xceedingly difficult adequately
be. The *whole of the metro-
illuminated as light as* noon-day, and the atmosphere was remarkably clear. The southern hemisphere at the same time, although unclouded, was very dark; but the stars, which were innumerable, shone brilliantly. The opposite side of the heavens presented a singular, but magnificent contrast, it was clear in the extreme, and the light was remarkably vivid. There was a continual succession of meteors varying in splendour, they seemed to form in the centre of the heavens; and spread till they burst. The effect was electrical: myriads of small stars shot out over the horizon, and darted with such swiftness towards the earth that the eye could scarcely follow their track; they also seemed to burst and spread a dark crimson vapour over the entire hemisphere. The colours were the most magnificent ever remembered. At half-past 2 o'clock the spectacle changed to darkness, which, on dispersing, displayed a luminous rainbow in the zenith of the heavens, and round the ridge of darkness that overhung the southern portion of the country. Soon afterwards columns of silvery light radiated from it, they increased wonderfully, intermingled amongst crimson vapour, which formed at the same time, and when at full height the spectacle was beyond all imagination. Stars were darting about in all directions, and continued until four o'clock, when all died away. During the time that they lasted, a great many persons assembled on the bridges across the river Thames, where they had a commanding view of the heavens, and attentively watched the progress of these interesting phenomena.

Of the seventeen total losses I may observe that in *two* instances the distance was so great between the fire and the nearest engine station, that it was utterly impossible for the firemen to accomplish the rescue of the premises in which the fire began. The first being a very small house at Acton Green, Middlesex, burned down 3¾ P. M., Jan. 2, in the occupation of S. Barnes, laundress, and set on fire by a drying-stove. The other was situated in Ordnance Row Lewisham, being the premises of C. Layland cabinet maker, consisting of a small house and workshop. The origin of this fire was not discovered; it broke out at 10 P. M. on the 17th December. In *five* instances, the premises were old and small, and principally composed of timber; of this class were the following:—

January 5th, 8, P. M., Palmer's Terrace, Holloway; a coach-house and two stables burned down, caused by accident.

January 6th, ½ A. M., High-street, Islington, a very old wooden building, occupied by Mr. R. Jackson, hairdresser, &c., was burned down, and six buildings of a similar character adjoining, were only saved from one common fate by the most extraordinary exertions of the firemen, the origin of the fire remains undiscovered.

October 11th, 3¾ A. M., 12, Crombie's Row, Commercial Road, East, a small house only one story high, occupied by A. Locker, tobacconist, was consumed; three buildings adjoining, though damaged, were saved by the efforts of the firemen.

December 10th, 5¾ A. M., Mill-street, Old Kent Road. A small timber shed, belonging to Mr. Bowen, coach-maker, was consumed before any assistance could reach the spot; cause undiscovered.

December 14th, 4½ A. M., 102, Bermondsey-street. A small timber building four stories high, occupied by Mr. T. Medley, horse hair manufacturer, was burned down, a horse in the stable beneath, being burned to death. The cause of the fire was not known, and water was not obtained time enough to enable the firemen to save any portion of these premises; those adjoining, although at one time on fire, were preserved. Upon *seven* occasions the premises were so completely on fire before any alarm was given, that they were consumed before the engines could be brought to bear upon them; this was particularly the case in the following instances, viz.:

June 6th, 2¾ A. M., No. 3, Smith's Buildings, Long Lane, Bermondsey, F. Hobden, green grocer, cause unknown, consumed, and two adjoining buildings damaged.

June 18th, 10½ A. M., No. 1, John-street, Brick-lane, St. Luke's, C. Pack, leather cutter, burned down and four adjoining buildings more or less injured, cause not known.

September 10th, 4¼ A. M., Bere-street, Butcher Row, Ratcliffe, the cooperage of Messrs. Ashcroft and sons. The cause of this (the second fire on these premises this year,) was never discovered. That on the 11th of May was caused by the flue of a furnace, and did considerable *damage to the* stock and building in *the stave loft*, but was early discovered and promptly extinguished. Upon the present occasion the fire was not discovered till the flames burst forth with a vehemence that defied all opposition, and the quantity of combustible materials within their reach, caused a most terriffic conflagration. The speedy arrival of the various engines, with a plentiful supply of water, prevented the fire extending as it at first threatened.

September 28th, 2½ A. M., No. 7, Mount Row, Westminster Road, the dwelling-house and shop of Mr. Price, hairdresser. The origin of this fire is unknown, and it was not discovered until the lower part of the premises was enveloped in flames which ascended rapidly, but the floors gave way and fell, long before the contents of the building were consumed. The adjoining premises were at one time in imminent danger, but were preserved comparatively uninjured.

November 12th, 6¼ A. M., No. 10, Widegate-street, Bishopgate-street, the scaleboard manufactory of Mr. John Barton. The cause of this fire is enveloped in mystery, it had obtained so great a head before discovered, that it was difficult to ascertain even the spot where it began. The firemen were quickly on the spot, but within ten minutes of their arrival the front walls of two buildings fell in, nearly burying some of the firemen in the ruins. The fire communicated to several buildings around, but was vanquished in all (ten in number) except those in which its ravages commenced.

November 28th, 10¾ P. M., No. 5, Crown-street, Walworth, the premises of E. Davis, pawnbroker. This fire originated in an escape of gas; the shop was one mass of flames before discovered, and the whole of the building was ignited before an engine could possibly arrive. The firemen were promptly on the spot, but for upwards of half an hour no water could be obtained; when it did arrive, however, the supply was abundant.

December 31st, ¾ A. M. No. 22, Goswell Road, W. B. Pretty, linendraper, cause unknown. This fire had attained such a head before discovered, that the premises were completely on fire before the arrival of any engine; in addition to which, the supply of water was very scanty, although so short a distance from the New River Head.

The three remaining total losses were

ollowing, each being distinguished
culiarity of circumstance:—
ly 13th, 10½ P.M., Quaker-street,
lfields, T. Okey, basket-maker, the
of this fire is unknown; it broke
n a large osier warehouse, which,
an immense stock of the same ar-
in the yard, was entirely consumed;
eat generated by this mass of com-
bles was so great, as to set fire to,
damage thirty buildings situated
d Mr. Okey's premises.
y 24th, ¾ A.M., White Lion Pas-
Harrow Road, J. Elliott, Candle-
r. This fire originated accidentally
boiling-house, a small building on
round floor only, which from the
y inflammable nature of its con-
and its distance from the nearest
n, was entirely destroyed before
ance reached the spot. Three ad-
g buildings, however, were pre-
l with comparatively little damage.
vember 1st, 7½ P.M., 10, William-
, Pimlico, the house of Mr. Hard-
irework manufacturer. This fire
ccasioned by the explosion of some
rks in the course of manufacture,
ich eight lives were lost, and the
ng instantaneously ignited from
bottom. The foregoing comprises
total losses, and which are for the
part of a very insignificant charac-
hat at the osier warehouse is in
he only extensive fire, and even
the amount of property destroyed
ut small.
following were serious fires both
gards the value of property de-
d and the appearances of the con-
ion, which assumed a most alarm-
spect; the prompt attendance of
remen, and their unwearied exer-
were, however, crowned with com-
success, parts of each particular
ng having been snatched from the
s flames and preserved as a trophy
persevering energy and skill of
nquishers.
uary 16th, 7¾ P.M. The Caout-
Company's establishment, Fac-
ne, Tottenham. This fire origi-
accidentally, and burned down the
ouse, engine-house, and their con-
but notwithstanding the inflam-
character of the manufacture and
tance from town, the London fire-
e reached the spot in time to save,
ir praiseworthy exertions, the ma-
ory and all its contents.

February 11th, 1¾ A.M., Jamaica Level, Rotherhithe, the beer-shop of Mr. J. Pearce. Cause unknown. Building and contents nearly destroyed.

April 16th, 3 P.M., No. 1, Bedford-row, Rotherhithe, T. Darley, ship-chandler. Cause unknown. House seriously damaged all through, and six other buildings more or less damaged.

May 3rd, 8½ A.M., Messrs. Bishop and Pell's Distillery, Ropemaker-street, Finsbury, took fire accidentally, and was considerably damaged, both stock and building. Three other buildings were slightly damaged.

May 4th, 4¾ P.M., No. 50, Old Compton-street, Soho. E. Fox, oilman, &c. Origin of fire undiscovered. The back part of the premises was destroyed, and the front and contents seriously injured.

May 20th, 2 A.M., No. 30, Bucklersbury, Cheapside. Mr. Unwin, printer. Cause unknown. The upper part of the house and contents destroyed, and four other buildings damaged.

June 21st, 11¾ P.M., No. 1, Vinegar-yard, Drury-lane, S. Wellar hat and cap maker. Cause unknown; building seriously damaged throughout, and four adjoining buildings slightly damaged.

July 15th, 9¼ P.M., No. 18, Upper East Smithfield, J. G. Mander, pawnbroker, two upper floors with contents entirely destroyed: three other buildings damaged.

August 14th, 3¾ A.M., No. 2, Holland-street, Blackfriars-road, H. Hardingham, copper-plate printer. Cause unknown. The building and contents very seriously damaged.

August 20th, 9¼ P.M., No. 72, Cheapside, Mr. Jennings, hatter. Cause unknown. Back part of premises destroyed, and three other buildings seriously damaged.

August 23rd, ½ A.M., Webber-street, Blackfriars-road, Mr. Winter's comb manufactory. Cause unknown; two upper floors and contents destroyed.

September 2nd, 2 A.M., No. 59, London-street, Tottenham Court-road, J. Merrick, boot and shoe maker. Cause unknown; house burned all through and contents destroyed.

September 18th, 9½ P.M., No. 19, Frith-street, Soho, W. Searle, bookbinder. Cause unknown. Back workshops burned out and three adjoining buildings damaged.

October 3rd, 7½ A.M., No. 272, Strand,

H. Green, milkman. Some children playing with lucifer matches set fire to the bed furniture in the back room ground floor, from whence the flames rapidly extended themselves, and the house and contents were all but destroyed, and five surrounding buildings variously injured.

October 25th, 10¾ P.M., Blue Anchor Road, Bermondsey, Messrs. Pewtress, Low and Pewtress, paper mill. Caused by accident. The engine-house and finishing rooms burned, rest of building saved.

December 2nd, 11½ P.M., No. 93, High-street, Shadwell, W. Champion, linendraper, &c. Cause unknown; building with all its contents nearly destroyed, and six other buildings damaged.

December 12th, 1½ P.M., Elliott's wharf, Mill-wall, Poplar, Messrs. Jeggon and Co., tar and turpentine distillers. In drawing of pitch it accidentally ignited and occasioned serious damage to a considerable portion of the building and contents.

Upon all these occasions the firemen acquitted themselves in the most creditable manner, and nothing short of their indefatigable efforts could have placed these fires out of the list of *total losses.*

In the following list the occupancy of the premises in which these fires have occurred is set forth, discriminating between fires originating in that portion of the building devoted to the purposes of trade or manufacture, and such as have happened in, and damaged dwelling-houses only.

Asphalte works	1
Bagnios	5
Bakers	13
Basket-makers	1
Barge and Boat-builders	2
Beer-shops	5
Booksellers, Binders, and Stationers	8
Brewers	1
Brokers and Clothes-salesmen	4
B uilders	1
Cabinet-makers	7
Caoutchouc manufacturers	2
Carpenters and workers in wood (not abinet-makers)	22
Chandlers	6
Charcoal and Coke, dealers in	4
Chemists, including all places containing laboratories for chemical purposes	9
Coach-makers	2
Coffee-roasters	2
Coffee-shops and Chophouses	3
Coopers	2
Cornchandlers	1
Comb-makers	1
Cotton-merchants	2
Curriers	2
Churches	1
Drapers, Linen, Woollen, and Mercers	15
Distillers	2
Ditto, Illicit	1
Docks	1
Eating-houses	4
Farmers	2
Flax-dressers	2
Firework-makers	4
Furriers and skin-dyers	1
Glue-makers	1
Gas-works	1
Glass-bender	1
Grocers	8
Carried forward	150

Brought forward	150
Hat-makers	9
Horsehair-manufacturers	3
Hotels and Club-houses	2
Japanners	3
Laundresses	4
Leather (Patent) Makers	2
Lodgings	52
Lucifer Match-makers	13
Mattrass-makers	1
Musical Instrument-makers	1
Oil and Colourmen (not colour makers)	8
Oil Works	1
Painters, Plumbers and Glaziers	3
Painted Baize-makers	1
Paper-makers	2
Paper-stainers	1
Pipe-maker	1
Printers and Engravers	4
Ditto Copperplate	3
Private dwellings	161
Pork-butchers	1
Potteries	1
Pawnbrokers	4
Rag-merchants	3
Rope-makers	2
Sack-makers	1
Sale-shops and Offices (no hazardous goods)	30
Saw-mills	2
Stables	14
Steam-ships	2
Steam-boiler Makers	1
Ships	5
Ship-builders	1
Ship-chandlers	1
Soot-merchants	2
Tallow and Wax-chandlers and melters, and Soap-boilers	8
Tailors	8
Carried forward	511

Brought forward	511
Tanners	2
Tinmen, Braziers, and Smiths	7
Tobacco-manufacturers	5
Unoccupied	4
Under repair and building	5
Upholsterers	3
Victuallers, licensed	31
Carried forward	568
Brought forward	568
Wadding-manufacturer	1
Warehouses	4
Ditto Manchester	1
Wine and Spirit merchants	8
Wood merchant	1
Workhouse	1
Total	584

The number of fires on each day of the week during the past year was as follows :—

Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.
82	97	78	87	78	99	63

Their distribution over the twenty-four hours has been in the following proportions :—

	First Hour.	Second Hour.	Third Hour.	Fourth Hour.	Fifth Hour.	Sixth Hour.	Seventh Hour.	Eighth Hour.	Ninth Hour.	Tenth Hour.	Eleventh Hour.	Twelfth Hour.
A.M.	40	31	18	25	16	11	11	17	11	15	15	15
P.M.	30	12	16	24	17	30	30	46	38	47	37	32

The promptitude with which attendance is now given in case of fire by the London Fire Establishment, enables the men not only to stop the progress of the fire, but also in the majority of cases to ascertain how it originated. The popular notion of the causes of fire has of late years somewhat improved, although we are even now occasionally told by the "Gentlemen of the Press," that such and such fires have happened from "the *bursting* of a gas pipe;" "the boiling over of a *glue*-pot;" or "the breaking of a bottle of *vitriol*;" all of them positive absurdities when put forward as causes of fire.

It is a very common error to suppose that a very large proportion of the metropolitan fires are wilfully occasioned. By the following epitome it will be seen that this is a very palpable error, for if the whole number of *undiscovered* causes of fire were admitted to be wilful (evidently a most unjust admission) still it would form but a small proportion to the whole. The undiscovered fires are, for the most part, those in which the flames have spread so extensively before they are observed, that it becomes very difficult to assign a cause for, or even the place of their origin. The ascertained causes of fire are very much of the usual character; the accidents arising from the hazardous manufacture of lucifer matches continues to increase, and although seldom attended with very serious consequences, they still occasion considerable alarm in the neighbourhood, and constitute a most intolerable nuisance. No less than eleven fires, some attended with considerable damage have occurred from the use of Sir Walter Raleigh's favorite weed; intoxication, "the giant sin of England" has also had its share in producing disastrous fires. The usual amount of carelessness in the use of fire and candles, continues undiminished, and great want of caution generally still prevails.

There have been occasioned by—

Accidents of various kinds, ascertained to have been for the most part unavoidable, (1 *fatal*)	23
Apparel, ignited on the person *(all fatal)*	3
Candles, various accidents with	44
Ditto, setting fire to bed curtains (1 *fatal*)	57
Carried forward	127
Brought forward	127
Ditto, Ditto to window curtains	27
Carelessness, palpable instances of	14
Children playing with fire	12
Fire, sparks from	9
Fires kindled on hearths and other improper places	8
Carried forward	197

Brought forward	197
Fire-heat applied to various purposes of trade and manufacture	26
Fire-works (2 *fatal*)	5
Friction of machinery	2
Fumigation, incautious	5
Furnaces, overheated, &c.	20
Flues, stopped up, defective, and ignited	58
Gas, sundry accidents from escape of.	63
Gas, accidents in lighting of	9
Gunpowder	2
Intoxication (2 *fatal*)	6
Lamps, sparks from, &c.	4
Lime, heating of	2
Linen, &c., airing before fire	26
Lucifer matches, making of	12
Ditto, using of	5
Ovens, defective, overheated, &c.	4
Carried forward	446

Brought forward	446
Reading in bed (1 *fatal*)	2
Shavings, loose ignited	8
Spontaneous ignition of coals	1
Ditto ditto of dung	2
Ditto ditto of flax, hemp, and cotton	4
Ditto ditto of hay	2
Ditto ditto of paper waste	1
Ditto ditto of rags	1
Ditto ditto of tan	2
Stoves and stove-pipes, overheated, &c.	24
Suspicious	6
Tobacco smoking	11
Wilful	7
	517
Undiscovered (4 *fatal*)	67
Total	584

The number of *fatal fires*, as also the number of lives lost last year was considerably greater than usual; the circumstances connected with these deplorable events, are briefly as follows:—

The first fatal fire occurred March 2nd, 9½ P.M., on the premises of Mr. Marshall, steam boiler maker, Colchester-street, Whitechapel. This accident arose from the bursting of a new boiler while under proof, and Samuel Marshall, a fine youth 15 years of age, and Richard Sterne, a workman, aged 32, were killed by the explosion upon the spot, both the bodies being dreadfully mutilated. The coroner's inquest returned a verdict of "Accidental death." The boiler fire being blown about the premises ignited some straw, &c. in the yard, which rendered the attendance of the firemen necessary, and constituted this a fatal fire, although the unfortunate sufferers were not burned to death.

The second fatal fire took place on Monday, May 20th, at 2 A.M., at the house of Mr. Unwin, printer, No. 30, Bucklersbury. The fire seemed to have begun in a first floor back room, but its cause could not be ascertained. There were sleeping in the house at the time, Mr. and Mrs. Unwin, a young woman, their daughter, and two sons aged 9 and 10 years, two apprentices, and a female servant. The fire seems to have been discovered about the same time internally by one of the apprentices, and externally by one of the city police, who ran to the Watling-street engine-station and gave an alarm of fire *in the Poultry*. The firemen instantly turned out, but on *reaching the Poultry* they found the fire to be in Bucklersbury; by the time the engines were drawn round, the situation of the fire became too apparent. The apprentice who first discovered the fire ran down stairs and alarmed his master and mistress, and Miss Unwin, as well as the servant maid, and then made his escape by the roof of the house. Miss Unwin precipitated herself from an upper window before the arrival of the firemen, who found Mr. and Mrs. Unwin at the third floor window imploring help. The portable fire ladders were promptly raised, and Mr. and Mrs. Unwin brought down in safety, when they begged an effort might be made to save their children. Junior fireman, Richard Dwight, No. 74, attached to the Watling-street station, accordingly ascended the ladders to accomplish, if possible, their rescue, but he became enveloped in fire and smoke which burst forth from the window, and fell from the ladder; he was taken up in a state of insensibility and conveyed to the hospital, when his leg was found to be fractured, and his face dreadfully burned. While these heroic efforts were making to save life, the fire was gaining a little additional ascendancy, but the prompt attendance of a strong muster of the firemen and engines, aided by a plentiful supply of water, soon effected the suppression of the fire, and preserved comparatively uninjured the lower part of the house, and the two adjoining buildings, to which the fire had communicated. In a short time the premises were cool enough to be entered, when the body of the servant maid was seen lying across the joists of the second floor back room,

sadly mutilated; the bodies of the two children were found to have fallen with part of the ruins on to the first floor, and the body of the apprentice was subsequently extricated from the ruins.

At a coroner's inquest held upon their bodies a verdict of accidental death was returned, and "the jury unanimously expressed their approbation of the excellent behaviour of the senior apprentice (George Elmes Nias) in arousing the family before he made any preparation to secure his own safety; and also of the praiseworthy conduct of the firemen and police on the occasion. The jury feel that it was only by the persevering exertions of the firemen at the imminent risk of their lives, that Mr. and Mrs. Unwin were rescued from their perilous situation." Miss Unwin was once shipwrecked, and in danger of perishing by water, but she has stated that the wreck, the horror of the waves was nothing—*nothing* to the terror of the flames—*nothing* to the agony which she underwent for those few minutes when she seemed to be in danger of death by fire! She opened her room door and the flames burst in upon her, and she describes the unutterable terror of that moment as far surpassing anything that she felt when in danger of shipwreck.

The next fatal fire was on the 6th of June, 2¾ A.M., at the house of Mr. F. Hobden, greengrocer, No. 3, Smith's-buildings, Long-lane, Bermondsey, when an aged female named Humphries was burned to death. The neighbourhood where this fire occurred is composed chiefly of narrow lanes and alleys, densely populated; there were eleven families, amounting to thirty-two individuals (mostly women and children), in the house which was burned. The inmates finding their retreat cut off by the street door were thrown into a state of indescribable confusion, but some one way and some another, all contrived to make their escape, except the unfortunate woman who lost her life; she slept in a small room on the ground floor, and her bed was close to a window, from which she could easily have made her escape, but that she was lame and enfeebled by old age. Several of the other inmates escaped through the window of the deceased's room, but the poor creature herself was forgotten in the hurry to save their own lives. On the firemen's arrival they were informed that the whole of the inmates had escaped; and it was not till ten o'clock that morning that the body of Mrs. Humphries was found, burned in a shocking manner, lying amongst the rubbish beneath the spot where her bedstead stood. The fire is supposed to have originated in a room adjoining that of the deceased, but its cause was never satisfactorily ascertained.

The next fatal fire was on the 25th July, 10¼ A.M., at the house of Mr. Cannon, firework maker, No. 3, Asylum-buildings, Westminster-road. This accident arose from the explosion of some fireworks in the course of manufacture, by which Mr. Cannon was so severely scorched and mutilated that he soon expired; the building was seriously damaged, but the flames were speedily extinguished.

On the 29th September, 2 A.M., a fire broke out on board the *Duke of Clarence*, lying in the West India Export Dock, The Dock engines were promptly on the spot, and the fire was soon subdued, when Moses Fox, the second mate, was found burned to death in the cabin. It seems that the deceased (contrary to the Dock regulations) had concealed a light on board, and, from the Bible being found half consumed, the inference was that he had been reading and had fallen asleep when the cabin took fire, and unable to extricate himself had fallen a victim to the flames. The captain of the vessel gave the deceased an excellent character, representing him to have been a most sober and religious man, and the jury returned a verdict of "accidental death."

November 1st, 7½ P.M., a calamitous fire occurred at the house of Mr. Harding, firework maker, No. 10, William-street, Pimlico. Eight individuals were busily employed in making fireworks, when by some unfortunate accident the whole exploded, with a noise that shook the neighbourhood, and set fire to the building. For some minutes it was dangerous to approach the burning premises, on account of the rockets and other fireworks which continued to issue from the parlour window. Some persons got to windward and battered in the front door; the whole interior, however, was one body of vivid flame, which prevented their entrance, and in a few minutes the flames had shot up through the roof. A large engine from Messrs.

Elliott and Co.'s brewery was soon on the spot, quickly followed by those from the various brigade stations, which were soon in full operation, but all efforts to save this ill-fated building were unavailing. Mrs. Harding was found lying in the back yard in a most deplorable condition, burned from head to foot; she was taken to the Westminster Hospital, where she soon expired; Mr. Harding, two women, and four boys, perished in the room where they were following their dangerous occupation.

On the 12th of the same month, 6¼ A.M., a destructive fire suddenly broke out in Widegate-alley, Bishopsgate-street, which was, like the former, attended with the loss of eight lives. The fire was first discovered by a city policeman, No. 385, who had just left duty and was returning to his residence in Windsor-place, at the back of the premises burned down. On passing down Widegate-alley he found it filled with a dense volume of smoke, of which he could not discover the origin. However he instantly sprang his rattle and aroused the neighbourhood by knocking at the doors. While thus engaged, flames burst forth from the back of No. 10, in the occupation of Mr. John Barton, scaleboard manufacturer, who let out the upper part to several poor families. Attached to this building was the manufactory, consisting of two brick buildings one story high, where the fire is supposed to have originated, but it has never been satisfactorily ascertained whether it began here or in the dwelling apartments of the unfortunate sufferers. The firemen from the adjacent engine stations were promptly on the spot, and as soon as water could be obtained several engines commenced working on the burning pile, but they were scarcely in full operation when the whole frontage of the houses, Nos. 9 and 10, fell into the alley, and it was only by dropping their branch-pipes and making a precipitate retreat, that the firemen escaped being crushed by the ruins. By half-past eight o'clock, the exertions of the firemen had subdued the fire, and preparations were made for searching the ruins, which ended in the discovery of the bodies of Mr. and Mrs. Flood and three of their children, Mr. and Mrs. Hennessy, and Daniel Macarthy, who perished apparently *without having had* time to make a single *effort to escape*, and as it would seem, before any external discovery had been made of the existence of the conflagration.

Two fatal fires originated by females in a state of intoxication setting fire to their beds—lighting as it were their own funeral pyre—sad spectacles of the fatal consequences of intemperance.

The remaining fires in this melancholy list (five) had their origin in the wearing apparel of one adult female and three children taking fire upon the person, and causing death. Although but *five* cases of this kind have been attended, and therefore reported by the firemen, these accidents have been very numerous, and exhibit a frightful increase over former years. It was suggested by a humane individual, that in making charitable donations at the dwellings of the poor, among whom accidents of this kind are very frequent, the gift of a wire *fire-guard* would be a real blessing, and might often be the means of averting a heart-rending calamity.

Many circumstances connected with the fatal fires of the past year are peculiarly distressing; the suddenness and awfulness of the visitation—the utter helplessness of man—the painful and agonizing end of the unfortunate sufferers, furnish matter for serious reflection.

To those who would impugn the dispensations of Infinite Wisdom, and question the justice of his dealings with his creatures, I would only address the following beautiful lines from one of the hymns in the church service (by Cowper).

"Judge not the Lord by feeble sense,
  But trust him for his grace;
Behind a frowning providence
  He hides a smiling face.

Blind unbelief is sure to err,
  And scan His work in vain;
God is his own interpreter,
  And he will make it plain."

The supply of water generally has been good, but several instances of great deficiency has from time to time occurred. During the past year the Vauxhall (late the South-London) Water Company have been extending their mains in the Lambeth and Southwark districts, and have made a great parade about their supply in case of fire; there is, however, in reality, but little to be expected from them; not having any elevated reservoirs,

they can only depend upon their steam-engine being at work to supply any water at all, while the mains of the Southwark and Lambeth water-works being in immediate connexion with the reservoirs on Brixton-hill, these companies can, if proper alacrity is exercised by their turn-cocks, afford an instantaneous and abundant supply of water at fires throughout their districts.

The want of water has frequently been severely felt at places dependant upon the South London Company's supply. It may be recollected that three-quarters of an hour elapsed before a drop of water could be procured at the fire in Vauxhall Gardens some two years since—only a few yards distant from the Vauxhall water-works! It will be quite time enough to begin boasting when performances will justify it, to promise *everything* is easy, to achieve *anything* is often difficult.

Great as the number of fatal fires is, it would have been still greater, but for the courage, humanity, and prompt exertions of the firemen, policemen, and others. Several very narrow escapes have been encountered; perhaps the most signal was that at the fire at Mr. Green's, in the Strand, on the morning of the 3d October, The fire broke out in a small sleeping-room behind the shop, on the ground floor, and the flames spread so instantaneously, that the numerous inmates of the upper floors were ignorant of their danger until egress by the street door was cut off. Two policemen of the F division ascended the stairs of the next house, and rescued some of the lodgers over the roof. Some other policemen brought the portable fire-ladders (Merryweather's) from St. Clement's Church-yard, and, assisted by the beadle, raised them to the front windows in gallant style, and saved the rest of the persons who were in jeopardy. One of the parties thus rescued (Mr, John Done) addressed the following letter to the editor of the *Morning Advertiser*, which appeared in that paper, October 4 :—

"Sir,—I was an eye-witness, yesterday morning, of the usefulness attending the *fire-escape ladders* of St. Clement's parish, at the calamitous fire in the Strand. The promptitude of their use, and the facility afforded by means of their being apportioned into lengths, fully convinced me that the establishment of the like attempt at the prevention of loss from fire, ought to be adopted in every parish throughout this great city. It reflects great credit on the parochial authorities of St. Clement Danes, who have very judiciously stationed them on a spot where they can be obtained on any unfortunate occasion that may happen, and require their use. There were no less than 12 persons on the upper floors, who were unable to escape into the street except by these ladders, the lower part of the premises being on fire; and I may say, as one of the inmates, *I attribute my delivery solely to them.*

"ONE OF THE SUFFERERS.

"Strand, Oct. 3, 1839."

I had occasion in my last annual report to comment upon the disgraceful proceedings of the Society for Preventing Loss of Life by Fire; during the past year this bubble has burst and gone to pieces. The *exposé* which took place at the last annual public meeting of this society, opened the eyes of the public to the delusion that was being practised upon them, and settled this affair.* Legal proceedings have been instituted against the managers by some of the creditors, for the recovery of their money, and one of their late officers is now carrying on the speculation, and levying contributions *on his own account! O tempora! O mores!*

At sixty-two fires, several of them serious, no other assistance was present but that afforded by the servants and engines of the Insurance Companies. The total number of buildings, more or less, damaged by fire, was 740.

If praise or censure was to be awarded to the firemen, precisely in proportion to the increase or decrease of serious fires, and the amount of damage sustained, the result of last year's conflagration was such as to make it difficult to use language sufficiently commendatory. A very superficial acquaintance, however, with the subject, will suffice to show that such a course would be manifestly unjust. Fires have happened, and will happen, attended with such a concatenation of untoward circumstances, as to bid defiance to all the powers and skill that can be brought in array against

* Mr. Waugh, one of the auditors, stated the receipts of the year to be 1,700*l.*; and Mr. Dixon stated the liabilities of the Society to be upwards of 700*l.*

them. While in other instances, fires of an alarming aspect may, by fortuitous incidents, be suppressed with scarcely an effort. It is, perhaps, more truly said of this subject than of any other, that

"'Tis not in mortals to *command* success."

and that it is sufficient for our firemen to show that they have *deserved* it. It must be wholly impossible, after seven years' experience, for the men of the London Fire Brigade not to have improved. Their calling is no exception to the general rule, and numerous are the instances where they have given undeniable proofs that "practice makes perfect." The activity, skill and attention of the firemen seems to increase with the increase of fires, and their conduct for the past year has been truly exemplary and praiseworthy. Although upon several occasions the firemen have been placed in situations of extreme danger, the only serious accident was that already alluded to, viz., at the fire in Bucklersbury, when Richard Dwight was driven off the ladders by the flames and smoke, while attempting to rescue some children, who perished. His leg was fractured, and his face dreadfully burned. He has, however, recovered, and is now doing duty again as usual.

The greater number of engines have now been altered from six to seven-inch barrels, as noticed in my last report, and the whole apparatus of the Establishment is in a very complete and highly efficient state. The following is a list of the stations, number of men and engines, and also the names of the officers at each:—

Superintendent.—Mr. James Braidwood.

District A.—Jonathan Crookland, foreman.

Station 1.—Watling-street, Cheapside; three engines, and eight men; engineers, Hambleton, Henderson, and Hitchin.

Station 2.—Jeffrey's-square, St. Mary Axe; two engines, and seven men; engineer, Scott.

Station 3.—Wellclose-square, Goodman's-fields; three engines, and ten men; engineers, Girard and Towser.

Station 4.—Whitecross-street, Saint Luke's; one engine, and five men; engineer, Hambleton.

Station 5.—School house-lane, Ratcliff; one engine, and one man; engineer Chandler.

District B.—George Colf, foreman.

Station 1.—Farringdon-street, Fleet-street; three engines, and eight men; engineers, Storey and Marshall.

Station 2.—Chandos-street, St. Martin's-lane; three engines and eight men; engineers, Mallett and Loader.

Station 3.—High Holborn; two engines, and five men; engineer, Morris.

Station 4.—Crown-street, Soho; two engines, and five men; engineer, Dowding.

District C.—George Fogo, foreman.

Station 1.—King-street, Golden-square; two engines, and six men; engineer, Staples.

Station 2.—Wells-street, Oxford-street; one engine, and five men; engineer, Howell.

Station 3.—Baker-street, Portman-square; one engine, and five men; engineer, Mackay.

Station 4.—Horseferry-road, Westminster; one engine and one man; engineer, Birch.

District D.—Edward Bourne, foreman.

Station.—Waterloo-road, near Zion chapel; two engines, and five men; engineer, Bannister.

District E.—Edward Syer, foreman.

Station 1.—Southwark-bridge-road; two engines, and seven men; engineer, Fenn.

Station 2.—Morgan's-lane, Tooley-street; one engine and five men; engineer, Farlow.

Station 3.—Back of Rotherhithe church; one engine, and two men; engineer, Stagg.

Upper floating-engine, west side, south pier of Southwark-bridge, manned from each district in regular succession.

Lower floating-engine, off Rotherhithe church; engineer, Stagg.

The public continue to appreciate the present corps of firemen, as shown by the confidence they place in them, and the readiness with which they follow their directions in all cases of danger. Instances do, however, sometimes occur, in which householders very stupidly close their doors against the firemen, after an accidental fire, and refuse to give them any satisfaction as to the

cause, or the extent of damage done by the fire. It would always be better to admit one responsible man, say the foreman or engineer, and furnish him with such particulars as he may require, and obtain from him an assurance that there exists no farther danger. It is often erroneously supposed that the admission of the firemen entails an expense to the parties, but this is quite a mistake. If there has been a fire, the rewards to the firemen for priority of attendance are paid by the parish. If the chimney only has been on fire, it is always better to admit the firemen if they attend, because the magistrates in all such cases award the remuneration to the firemen (which in that case falls upon the householder) upon evidence of the fire having been seen *externally* and not *internally*; so that excluding the firemen does nothing —while their entrance oftentimes averts the evil consequences of lurking danger.

It is not generally known, and by few persons even suspected, that the expenses incurred by the London fire-establishment, in paying for calls, horses, and other contingencies incident upon turning out, very frequently exceeds the amount of damage done by the fire. In a recent periodical publication I met with the following :—

"*Advice to the Insured.*

"When a fire occurs, remove any plate or portable article of value to a neighbour's for safety; but upon the arrival of any firemen, no matter from what company, resign the charge to them, instructing them where the most valuable of your property is situated, and you may rest assured they will use the best of their judgment to secure it if possible from destruction, for your sake as well as their employers.

"*Advice to the Un-insured.*

"To those who have anything to lose—get insured."

It would be an act of injustice to close this report without noticing the laudable exertions of the West of England firemen under their foreman, Mr. Connorton, who have upon all occasions exhibited the utmost alacrity in their attendance, as well as the most unwearied and unflinching zeal, whenever and wherever their services have been required. They have continued to prove worthy rivals of, and valuable auxiliaries to the London fire-establishment.

To award the due meed of praise to Mr. Braidwood, it is only necessary to advert to the highly prosperous and satisfactory working of the system, of which he is the talented author and successful superintendent. While he has been so ably supported by the officers and men under him, he has upon all occasions shown himself worthy of being their leader, and to all of them I would say, "Go on and prosper."

That this fortunate, and to the public as well as to the insurance companies, this highly advantageous establishment may continue to discharge their onerous duties with the same success as heretofore, is the earnest prayer of

Sir, yours very respectfully,

WM. BADDELEY.

5, Chester-terrace, Borough-road, Southwark.

FONTAINEMOREAU'S IMPROVED SYSTEM OF WOOLCOMBING.*

This is one of the most important inventions which has been made in relation to the wool manufacture for many years: a correspondent informs us that 93lbs. of the best wool has been obtained from every 100 lbs., of undressed wool submitted to treatment by this new process. By the common methods in use, 65 per cent is considered a very large product. By M. Fontainemoreau's new system the wool is combed for the most part by machinery, by means of combing engines (somewhat similar to carding engines but with two large drums), and is only finished by hand. Both the engines and the hand combs are heated by steam, and it is in a great measure to the beneficial action of the steam that the advantageous results above-named are to be attributed. The following account of the process is abridged from the specification :—

The wool to be combed or dressed is introduced to the action of a combing engine, similar to a carding engine, but with two great drums, by an endless feeding-cloth in the usual manner followed in carding engines (the wool having been previously well cleansed or washed, but being still in a damp state). The main combing drum is covered with comb or card filleting, or teeth, and in connection therewith various

* Pierre A. Lecomte de Fontainemoreau. "Certain improvements in Woolcombing," communicated from a foreigner. Patent dated 6th August, 1838. Specification enrolled Feb., 1839.

the rollers, also covered with filletings of comb or card teeth, work. A smaller combing drum, provided also with rollers with their comb or card fillets, working into the teeth of the drum, as before-mentioned of the main drum, is placed next it, and upon which the wool receives a first preparation, before passing to the main drum.

These two drums are heated by the steam boxes or cases, formed in the shape of segments of cylinders, and large enough to be about coincident with a third of the drums, and placed in proximity to that portion of each drum or cylinder which is lowest in the course of its revolution. The two segmental steam cases or boxes are connected, and communicate with each other by pipes or channels, and are kept supplied with steam by a pipe leading from a boiler, and the water of condensation is drawn off by suitable cocks. The steam thus supplied to these cases or boxes gives off its heat to the wool on the cylinders covered with filletings of comb or card teeth, by which the wool is heated in a beneficial degree in the process of carding, whereby it is capable of a greater degree of expansion, and is rendered more elastic, allowing its fibres to be stretched or extended without being torn while being carded, as also in the subsequent operations it has to undergo. The wool having passed through the whole engine, is taken therefrom by a discharge or doffer roller, and doffer comb, and thence passing through a funnel falls into a can placed to receive it in a continuous sliver of patted wool. After this first operation of engine combing, the wool is prepared by stretching it by means of twisting in the manner following:—Six or eight doubles or strands of the sliver or patted wool, are fixed together at each end, and placed upon the hooks of twisting apparatus, one hook being fixed whilst the other is made to revolve by cogs, on turning a handle in connection therewith. Thus the slivers of wool are twisted into a kind of cord. The degree of twisting to be given will vary according to the quality of the wool; which should be less twisted in proportion as it is more fine, and the fibre more delicate, and consequently liable to break. The length of cord twisted is usually about eight or *ten feet.* The object of this twisting is to render straight and to stretch out the fibres of the wool, so that no twisting or stretching will be required after the combing is completed. Instead of this twisting apparatus, a spindle similar to that used for spinning or twisting cotton and other fibrous substances may be employed.

The twisted cords or bobbins of wool having been formed as before described, are placed for about ten minutes in a box lined with zinc, into which steam is conducted by a pipe having a cock, and communicating with a boiler. This heating with steam is for the purpose of keeping the wool in the stretched or extended state in which the operation of twisting has put it. The wool having remained in the steam bath for about ten minutes, is to be taken out, dried, and put into a basket or other receptacle, and is ready to be subjected to the final operation of hand combing now to be described.

The comb bench may have any number of sets of combing apparatus attached to it, according to the number of combers employed, turned alternately one way and the other, for convenience and economy of room. A D-shaped pipe passes along the whole length of the bench, the flat part being upwards, and which forms the steam comb-heater. This steam-heater is supplied by a pipe from a boiler, and the water of condensation passes off at the other. The steam admitted must be of such a temperature as to give the necessary heat to the combs placed upon the steam-heater, from time to time, during the process of hand-combing, which is carried on in nearly the same manner as hand-combing at present, only the combs are heated by steam as before described, instead of with charcoal or coke fires, or chafing-dishes.

This manner of heating the combs by steam is more economical than the method now in use of heating them by coal, coke, or charcoal fires; the temperature produced is also more beneficial to the operation of combing, and healthier to the combers employed. The combs used in the manner hereinbefore described, are of a smaller size than those ordinarily used, being about three inches wide, and the teeth two inches in length; so that women may do the work usually performed by men.

CROMPTON'S IMPROVEMENT IN THE PAPER MAKING MACHINE.*

Sir,—In making paper by Fourdrinier's machines, the pulp is spread over an endless wire cloth, under which a partial vacuum is produced; so that by the pressure of the atmosphere, the water or moisture is separated from the fibre. To produce this vacuum, or partial vacuum, expensive air-pumps have been used, and there is this disadvantage attending the use of the air-pump, that owing to the change of stroke of the pistons, an uniform degree of vacuum cannot be maintained; so that the pulp on the wire cloth passing over the vacuum chamber, receives various degrees of pressure, and consequently the paper is made of various thicknesses. The object of Mr. Crompton's invention is to maintain this partial vacuum at as uniform a degree as possible, in order that the atmosphere may press on all parts of the paper equally at all times, as it is progressively made by the endless-web and pulp passing over the vacuum chamber.

Mr. C. proposes to accomplish this by the substitution of a revolving fan, for the air-pump, to withdraw the air from the vacuum box. To those acquainted with paper making machinery, very little further description is necessary. The pipe or trunk, which in Fourdrinier's machines as at present constructed, leads to the air-pump, should lead to a case containing the revolving fan, which may be placed in any convenient position with respect to the machine to which it is applied. It is desirable to avoid bends or projections in this pipe or trunk. The fan may have any number of vanes, and of any shape; an odd number is, however, best. A water-syphon gauge is attached to the vacuum box to indicate the pressure, which may be regulated to a nicety by varying the speed of the fan employed. The speed which has been found to answer best is about 1,200 revolutions a minute.

* Thomas Bonsor Crompton, of Farnworth, Bolton, Lancaster, paper manufacturer, "Improvements in the manufacture of paper." Patent dated April 9th, specification enrolled October 9th, 1839.

EVANS'S IMPROVEMENT IN THE PAPER MAKING MACHINE.*

This invention has also for its object the production and preservation of a uniform degree of vacuum beneath the endlees wire web over which the pulp passes in making paper with the Fourdrinier machine, and this by an apparatus cheaper than the common air-pump, easier worked, and less liable to derangement. Mr. Evans substitutes for the common air-pumps, hydraulic air-pumps, working on the principle of gas-holders, thus:—three cylindrical, or other shaped vessels, open at one side or end, and having valves in the top, opening outwards, are placed mouth downwards in three other vessels, or in one vessel divided into three compartments, open at top, and containing water. Three vertical tubes or pipes rise out of the horizontal tube or pipe leading from the vacuum box, through the bottoms of these last-named vessels, or one through each division, if one vessel with partitions be used. The tops or mouths of these pipes are on a level with the top of the vessel, and each mouth is covered with a valve opening outwards. The first mentioned cylindrical vessels are placed mouths downwards in the water and over these tubes, and are connected to a three-throw crank by connecting rods, so that the three vessels worked thereby shall always be at different parts of a stroke at the same moment. The invention is in fact the application of an arrangement of three, or any other number, of the hydraulic blowing machines in common use at iron foundries and in smelting works, to the purpose of producing the vacuum in paper machines. Uniformity of pressure is maintained by the variation of the parts of the stroke of each vessel at the same moment; so that the greater the number of vessels, the more uniform would be the action, and the use of an odd number is also advisable.

TWO PROMINENT DEFECTS IN PAPER MADE BY MACHINERY.

Sir,—Exterior attraction too often possesses a tendency to mislead judgment;

* John Evans, of Birmingham, "Improvements in the manufacture of paper." Patent dated Feb. 4th; specification inrolled August 3rd, 1839.

an outside showy tint is given to many of our most flimsily manufactured articles being the produce of machinery. I can go to a hosier's and purchase a pair of stockings for two shillings or eighteen pence, which will look better to the eye, and boast a more pleasing finish than a pair would do, manufactured by some thrifty old dame, at more than double the cost, in some village nook; but then, when we come to compare the two articles, on the basis of durability and comfort, the first mentioned fragile one, which issues from some loom at Nottingham or Leicester, is in a few weeks reduced to shreds and tatters, whilst its rival, of honest home manufacture, is still benefiting its owner by its warmth and strength, as he journeys on his plodding way to labour.

To quit prefatory remark, I will say that machinery has its disadvantages as well as advantages; to prove which I will confine myself to the paper trade. At the time when every sort of paper was made by the hand, a purchaser might depend upon a true uniformity of substance in the component parts of a ream, which he cannot do now; it is a common complaint among all consumers of paper throughout the country, that the substances of that made by machinery runs irregular and deceptious, one half of the quires being too stout, and the others (disproportionately) too light. As an instance, I sold a few days ago 50 reams of royal cartridge, to average 36 lbs. per ream, upon its being inspected it was found that one-half of the lot was not above half the substance required, and the remainder being too stout, the whole was consequently unsuitable; this defect is owing in the first instance to the carelessness or incompetency of the machine man, who superintends its making, and who suffers a too rapid, and sometimes too slow an escape of the pulp, and who afterwards, to rectify his oversight or ignorance, strives to correct it, by assimilating the two unequal divisions, so as to bring them to the average weight required The above defect (and it is a serious one) has existed ever since the introduction of paper-making by machinery, and seems to increase rather than diminish. The next deteriorating feature I will mention is, the mode of drying machine paper by the steam-*cylinder process;* this method of drying is so rapid in the transition, that it causes the article so treated to become brittle and friable, and to lose a great portion of the strength it would otherwise possess. I mention these points of faultiness in machine paper making, in hopes that they may be some day rectified, for the complaints are generally on both heads, but I fear greatly that the advantage which existed under the old mode of paper manufacture; viz., every sheet being subjected to the inspection of the artisan who made it can never be thoroughly realized by any dumb insensible servitor, such as a machine of any kind must necessarily be.*

I remain, Sir,

Your obedient servant,

ENORT SMITH.

THE UNANSWERED CHARGES OF PIRACY AGAINST MR. S. HUTCHISON—THE STATE OF THE ENGLISH PATENT LAW.

Sir,—The charge of systematic and comprehensive piracy, advanced against Mr. Hutchison in your *Magazine* for January, by the Rev. Mr. Bacon, is one of a perfectly astounding character. But the reflections to which that charge is calculated to give rise, extend far beyond the immediate subject of discussion. That any individual who has discovered a useful scientific improvement, should have found the fruits of his ingenuity wrested from him by such despicable artifices as Mr. Bacon has detailed, must be a matter of regret on mere personal grounds; and, that the rewards of inventive talent should not only have been lost to the inventor, but transferred to the pockets of an unworthy pretender, is an incident which it is impossible to contemplate without feelings of the liveliest indignation. But, however deeply our sympathies may be justly enlisted in this subject, viewed merely as a matter of personal interest, it is impossible not to perceive that the statements of Mr. Bacon, if unrefuted, are alone calculated to lead to conclusions of the highest importance to the general interests of the community, dependent as those interests are on a firm and consistent protection of the interests of science.

I should have considered any observations on this head premature, until a reasonable

* See descriptions of two newly-patented improvements in paper-making machinery, having in view, the correction of one of the defects complained of, page 389 of our present number.—ED. M. M.

time had been allowed to Mr. Hutchison to answer the accusations which have been published against him. It would have been unjust, it would have been impossible to reason upon such charges as those made by Mr. Bacon, as indisputable truths, until the accused party had possessed an opportunity of defence. But it is now upwards of three weeks since the publication of Mr. Bacon's letter, and, as during the whole of that time Mr. Hutchison has never replied to any of the accusations of piracy and fabrication advanced against him and his friends—not even intimated any intention of repelling those charges—it is no longer premature to offer those general observations which are suggested by Mr. Bacon's uncontradicted and most startling statement. It is obvious that that gentleman's narration may now be legitimately treated as an authentic practical illustration of the present state of the English patent law, and as such it opens a very extensive field for reflection.

Mr. Babbage, in his interesting work on the Decline of Science in England, while he laments the neglect of the Government, seems inclined, nevertheless, to consider that the reward held out by the patent laws, to scientific discoveries, affords a partial compensation for the want of direct encouragement on the part of our rulers. A closer attention to the history and practical working of these laws, would, I doubt not, have led this eminent philosopher to a widely different conclusion. Were a patent in reality, what it is only in name, an unerring badge of scientific merit, and an irrevocable guarantee of a public privilege, rewards of this kind would doubtless be productive of great public advantage. But what, alas! is the actual state of the matter? Patents may be taken out on mere payment of the fees! for the most shallow, the most noxious quackeries: or like that of Mr. Stephen Hutchison, for the fruits of other men's genius, the labour of other men's minds! True it is, that the jackdaw may occasionally be stripped of his borrowed plumage, still he is often enabled to wear them for a time, long enough to enable him to impose upon the credulous and ignorant, and to make the weak his prey, and the avaricious and corrupt, his instruments. On the other hand, patents for discoveries, which form an era in the history of the human race, so far from being secure and irrevocable, have exposed their possessors to a life of harrassing and dubious litigation—of all inflictions perhaps the severest, to the acutely sensitive mind of genius! In reading the Life of Watt, by M. Arago, the mind literally shrinks appalled at the mean *persecution by which that* great man's life was embittered. In closing the narrative, we feel it difficult to escape a sentiment of disgust with the very species to which we belong, at finding that there have been men base enough to apply the whole energies of their lives in subverting a reward, which might have been expected to receive the sanction of the unanimous voice of mankind! In reading these transactions, it is difficult to reconcile ourselves to the idea that they belong to a civilised age or nation. So much importance is attached to antiquated forms, so little to the grand land-marks of truth, reason, and justice. that it is impossible to discover any substantial superiority in the quibbles and miserable finesse, by which it was attempted to stifle the plainest rights of science and humanity in a court of law, over the more open and brutal oppression of the middle ages. Have the patent laws been improved since the trials to which Watt's patent was exposed? In some minor features there may be the semblance of improvement; but I feel assured that no one who has perused Mr. Bacon's narrative, can entertain a doubt that, these laws are still a mere mockery on men of science, and a blot on the legislation of this country. To judge of the objects to which they may be made subservient, I must quote the leading statement of Mr. Bacon's letter:—

"But Mr. Hutchison's patent was not confined to mine. 1. In the very same specification he actually patented *eight separate and independent inventions*, connected with the art of gas-lighting, which were all either taken from other men's patents, or notoriously in use before.

"2. Nor are his pretensions confined to the inventions included in his patent. Through the impartial pen of 'Clovis,' he has claimed as his patent inventions several improvements, of which he is *neither the patentee nor the inventor!*"

"3. He has claimed *without a patent, or the pretence* of a patent, a great number of discoveries notoriously not his own."

For this precious specimen of "Buccaneering," Mr. Hutchison has not been exposed either to fine or penalty. On the contrary, he has obtained by it the office of engineer to the London Gas Company, with an annuity of I know not how much a-year! It may be highly gratifying to our national vanity to talk of the great intelligence of the country in which we live; but the cause of truth, and the real interests of society, are better promoted by trying these lofty claims by the plain test of fact. It is notorious that until within the last few years, when a small pension was granted to him by Government, Dr. Dalton, the first experimental philosopher now living in this country

or in the world, earned his bread by teaching the elements of mathematics to the youth of Manchester, for 2s. 6d. an hour! Such men are neglected, while handsome annuities await the achievements of such men as Mr. Stephen Hutchison! And who are his patrons? Some of the very wealthiest capitalists in the City of London!

It may be humiliating to our national pride, but such a contrast could never have existed amongst our neighbours. A friend of the writer, while residing in France, was frequently asked what rank Dalton held in England. He answered "none." "What!" was the reply, "Dalton not a Peer"! In France, Dalton would undoubtedly have been elevated to the Peerage; in the same country Mr. Stephen Hutchison's piratical patent would have been next to impossible, as all claims of this nature must pass the ordeal of a scientific commission before they are recognised as deserving of a patent. The mere oath or averment of the applicant is of no avail.

Extensive, Sir, as are the scientific improvements that overspread the face of this great country, and profound as have been the discoveries of many of our distinguished men, I fear that the want of scientific information on the part of many of our more wealthy classes is truly lamentable, and I much question whether the future historian will not be more surprized by the success of St. John Long and other impostors among the rich, than by the insurrection of Thom and the superstitions which he will find to have lingered in our times among the poorer classes of Wales, Devonshire, and Cornwall.

Let us now examine a little more in detail into the practical workings of a system which tolerates such patents as that of Mr. Hutchison's, and allows them to be made the subject of speculation by a "company" of individuals, just as if they were as fair and innocent a subject of association as the supply of the metropolis with water, or the conveyance of parcels from one of its extremities to the other. Most of the discoveries which are patented are due to men of very limited means, frequently industrious mechanics—a patent is the compensation by which the state pledges itself to reward their inventive talent. But, alas! the fees of office, amounting to 100*l.* nearly, for England alone, are to most inventors an insuperable obstacle. Again, the unfortunate applicant has to encounter at every step the frauds of speculative and unprincipled capitalists, and the preliminary quibbles of the law. These obstacles have been so well and so ably depicted in a former number of the *Mechanics' Magazine*, that I need not dwell upon them, I shall pass on to a later stage in the history of a poor but meritorious inventor. His patent has been taken out, his invention has been duly specified, he has spent several years without profit from the difficulty of subduing those prejudices, that impede the progress of every new invention. But at last even this obstacle has rapidly given way, and he begins to reap a moderate amount of profit, the tardy and hard-earned reward of ingenuity and perseverance. His heart beats high, and he thinks his fortune is made, when lo! as he walks through one of the principal streets of the metropolis, he finds his own invention sold on a most extensive scale by a public company recently established. Moreover he finds to his surprize, that they have not only invaded his rights, but actually entrenched themselves in a patent, including not only his invention, but those of several other persons, whose discoveries seemed likely to be conducive to their objects. He attempts to obtain an interview with the directors or some of the respectable members of the association, but in vain, he finds his applications repulsed and his remonstrances treated with contempt!

In despair, he applies to his solicitor, who looks grave, tells him that according to the theory of the law, he is entitled doubtless to redress for so flagrant an injury, but points out to him the ruinous expense attendant on all litigation, and assures him that keenly as he feels the injustice of the case, he cannot forbear advising him to forego the plainest rights rather than involve himself and his family in ruin!

Such, Sir, are the practical workings of the patent laws to the poor inventor, whom in theory they are meant to encourage. So far from being a reward, they are a mere delusion to lure him on to ruin; to make him the sport, and the jest, and the prey of shameless and unprincipled adventurers. If such are the effects of these laws on poor inventors, can it be supposed that they afford any incentive to those who are blessed with affluence or competence?

When the certainty of expensive litigation is in prospect, no inventions but such as are highly productive, can afford a probability of profit. Is it consistent with the habits or the feelings of a man of science, for the sake of some dubious and distant chance of gain to exchange a settled income and tranquillity of mind, for the never-ending chicanery of the courts, and incessant collision with adventurers who may be the very dregs of society? I might mention, for example, the name of Sir John Herschell, one of the few eminent scientific men in this country who has the advantage of an independent fortune. I do not believe that he

would subject himself to the annoyance of one single action with persons such as those by whom patents are usually infringed, for the sake of the very highest rewards that the patent law is likely to bestow.

But there are other purposes to which a spurious patent may be rendered subservient. We will suppose a patent to have expired, and the invention, therefore, to have become the property of the public. Ten years, perhaps, after its expiration, a humble but ingenious mechanic exercises the right which he conceives to be open to all the world, and invests his little capital in making a stock of the article in question. He is proceeding to sell, when, behold! he finds himself stopped, not by the real inventor, but by an individual who has adopted the ingenious expedient of taking *a new patent* for the same thing, a patent to which he has no better right than to the steam-engine of Watt, or the safety lamp of Davy! Yet what can poverty do against wealth and numbers? The poor man must succumb, he must either forfeit his all or pay for *a licence!* He must pay "black mail." There is nothing ideal in this case, judging from Mr. Bacon's statement, it is precisely what Mr. Hutchison attempted when he endeavoured to compel the City Gas Company to desist from using the long-known invention called the double lifting gasometer. There was, however, this difference, that, having to deal with an opulent company, instead of a poor mechanic, he was obliged to abandon the attempt.

There is yet another purpose which may be served by taking out a spurious patent, or untruly representing certain articles to be protected by a patent, when in fact no such privilege exists. By these means an exorbitant price may be exacted from the purchaser, because over and above the ordinary profits of manufacture, a patentee may justly require an additional sum to repay him for the cost of a patent, and the time and labour, and anxiety of devising and maturing his invention, and bringing it into public use. When this additional profit is exacted, by means of a spurious patent, or under the pretence of a patent which does not exist, it is a flagrant deceit on the community, which well deserves to be visited by the penalties of the criminal law. But I feel that it is time these remarks should be brought to a close. The various forms which fraud may assume, if left uncontrouled, are too numerous to be detailed. In the mean time I trust these cursory remarks will not be altogether without their use in drawing public attention to evils of great magnitude, which press alike on the *inventor* and on the community *at large*. *That the existence of those evils* reflects but little credit on our laws or our country, is a conclusion from which I feel assured no candid or reflecting mind can escape. But, we are compelled to go farther. It cannot be disguised that we have positively retrograded; for there are features in the present state of this question more disgraceful than any which presented themselves during the times of Watt and Arkwright. The pirates of those days were content to destroy the rights of those great men; they made no attempt at a monopoly for themselves; but in our times we find the pirate claiming the rights of the patentee, and thus a privilege which was meant as a symbol of honour, as a reward of genius, has been boldly assumed as a warrant for unjustifiable extortion!

I have the honour to remain,
Your's faithfully,
SPECTATOR.

STEAM-CARRIAGES ON COMMON ROADS—NEW COMPETITOR.

Sir,—From the very little that has been written in several of the last monthly parts of the *Mechanics' Magazine*, respecting locomotive engines for common roads, I with many others had begun to fear that there was no immediate prospect of this very important question being practically tested, at least on such a scale, and with such engines as would be satisfactory; but I rejoice to state, for the information of all those who, like myself, feel an interest in this subject, that such is not the case.

Being a few days back in the neighbourhood of a gentleman whom I knew to have made several experiments with a small locomotive engine, I applied for permission to view the same. I was a perfect stranger to the proprietor, and the introduction which I obtained was by no means such as to warrant any sanguine expectations of receiving the favour asked, yet with that liberality that ever distinguishes men of real talent, and raises them above ungenerous suspicions, it was freely conceded.

I had been given to understand that the experiments made had been unsatisfactory, and that the project had been abandoned, as such I expected to see only a small engine, capable of carrying three or four persons, and I thought it a great chance if even this was in repair; judge then of the pleasure which I experienced, when the liberal proprietor opened the doors of his factory, and I beheld two powerful and handsome new engines. One is complete, and has been out several times; the other is nearly finished. The smallest will carry 15 persons, the larger one I believe 20; they are finished in the first

style, both as to machinery and decoration. In the machinery no expense appears to have been spared.

The carriages are driven by two cylinders of about 8 inches diameter, and 18 or 20 inches stroke; but to attempt to describe the arrangement of the machinery would, perhaps, be a breach of good faith. All that I can say on this point is, that I found the owner willing to answer all my questions, without reserve, in such a way and to such an extent as I had no right to expect, and for which I felt, and still feel, grateful. He speaks with every confidence of his success, and most sincerely do I wish him a full measure of it. The outlay must have been very great, but I trust the returns, and the self-satisfaction of triumph, will prove a rich reward.

In addition to the engines there is a large omnibus, fitted up in the style of first-class carriages on rail-roads, which can be attached to the engines.

I am, Mr. Editor,

Your's respectfully,

PHILO MECHANICUS.

Luton, Jan. 18, 1840.

PATENT LAW ADJUDICATIONS.

Asphalte Pavement—Claridge v. *Latrade. Court of Queen's Bench, Feb.* 11*th*, 1840.

Mr. Hoggins (who appeared with Sir F. Pollock for the plaintiff in this case) opened the pleadings, and stated that the plaintiff was possessed of a patent* for the exclusive use in this country of a certain bituminous cement, and that the action was brought against the defendant for an infraction of that patent. The defendant pleaded four pleas: first, that he was not guilty; secondly that the alleged invention was not new in itself; thirdly, that no legal and adequate specification had been made by the patentee of the nature of the invention; and fourthly, that the patent right had become vested in more than twelve persons, or was held for the benefit of more than twelve, and was thereby rendered void by a proviso in the patent itself.

Sir F. Pollock said, that two years ago the article for which the plaintiff claims an exclusive patent was laid down as a footway in Whitehall, and subsequently under the steps leading from Waterloo-place to St. James's-park; and of the utility, value, and beauty of this invention every person was in a condition to judge for himself. The learned counsel then proceeded to state the nature of the case in reference to each of the four pleas put by the defendant upon the record. Upon those subjects, however, it will be more satisfactory to hear the evidence of the witnesses and the charge of the learned judge, which are given below at full length. Upon Sir F. Pollock referring to the plea as to the avoidance of the patent in consequence of its having become vested in twelve persons,

Lord Denman requested a copy of the Act of Parliament which contained the proviso.†

Sir F. Pollock said there was no such Act. The plea had reference to a clause which was inserted in the patent by the advice of the Attorney-General, and the object of it seemed to be to prevent the patent falling into the hands of a large number of large capitalists, who would be able to keep the invention from the public, unless they obtained for it any terms which they pleased to demand. The learned counsel having concluded his statement,

Sir W. Follett, who appeared on the same side, put in the patent, which was dated on the 25th of November, 1837, and the specification, which was dated on the 25th of May following.

Joseph Twogood, surveyor to the commissioners for paving Whitehall and Regent-street.—I was directed by the commissioners to attend the laying down of the asphalte pavement by Mr. Claridge, in March or April, 1838. It was under the sole direction of Claridge, who attended hourly during the time. The process was quite new to me. I had never seen anything of the kind before. It is very useful. It is impervious to water. I have walked over it every day. It is incorruptible by air, and impenetrable by water.

The Attorney-General, reading from Johnson's Dictionary—The walls of Babylon were built with it.

Sir F. Pollock to the witness—Have you any acquaintance with the walls of Babylon?

Witness—I have been expecting to go there, but have been disappointed. The pavement was laid down exactly in accordance with the specifications.

James Carew—I was employed in October, 1838, in preparing the asphalte under Mr. Claridge. I afterward went into the employment of Mr. Latrade, on the Surrey side of Southwark bridge. The asphalte rock used by Ladrade was the same as what I had seen at Claridge's. It was said by Latrade to

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*The patent was granted to Mr. Richard Tappin Claridge of Salisbury Court, Strand, gentleman, for "a mastic cement or composition applicable to paving and road-making, covering buildings, and the various purposes to which cement, mastic, lead, zinc, or other composition, are employed—being a *communication from a foreigner residing abroad.*" —*Dated 25th Nov. 1837. See an abridgment of the specification, p. 399, of the present number.*

†This request of Lord Denman's shows in a striking degree how little that most important branch of legal knowledge—the patent law—has been made the subject of professional study.

have been brought from the Val de Travers. The process of preparation was precisely the same in both cases. At first Latrade used mineral pitch as Claridge did, but afterwards he used Stockholm tar, as he could get no more mineral pitch. The product was formed into square blocks, and put down in Oxford-street. There was no difference between any part of the process adopted by Latrade and that used by Claridge. The cauldrons were of the same sort, and the fire of the same heat. Some part of what was put down in Oxford-street, about one-third, was made with mineral pitch, as the blocks had been lying over for some time. Whilst I was in Latrade's service, I laid down the pavement in several places. I am a boot and shoemaker by trade.

Cross-examined by the Attorney-General —By "being in the service of Mr. Claridge," I mean in the service of "Claridge's Asphalte Company," at Stangate over Westminster bridge.

Another witness was called to prove the use of asphalte by the defendant, but the fact was admitted by the counsel for the defendant, who added that their asphalte was of a better description than that used by the plaintiff.

François Rosser—Is in the employment of Claridge's Company since March, 1838, and acquainted with the process. It has been used at Whitehall and several other places.

Cross-examined—It was used in several places in Paris, in 1825. The Boulevards have lately been paved with it, as well as the Place de la Concorde, and part of the Pont Royale and of the Champs Elysses were paved with it in 1838.

Mr. Cooper, a chymist, has turned his attention a good deal to patents, and analyzed the asphalte used by the plaintiffs. Analyzed the rock from Seyssell and that from the Val de Travers. The result was different at different times, there being a somewhat smaller proportion of bitumen upon one occasion than another. Has also analyzed the Norway pitch, which on being heated loses 24 per cent. of its weight and becomes much harder. The Stockholm tar in being heated loses about 62 per cent., leaving 38 per cent. of hard pitch. The asphalte of the Val de Travers shows upon analysis about the same result as the last analysis of the asphalte of Seyssell. When Stockholm tar is mixed withh the asphalte of Seyssell it makes a substance very analogous to the Bastenne bitumen. (Produces a tablet specimen of the combination.) The mixture of the Stockholm tar with the asphalte of the Val de Travers *would produce* the same sort of *resulting compound.*

Cross-examined—The specimens of Seyssell and Val de Travers asphalte were sent to me as well as the Bastenne tar from the works of the Claridge Company over the river. The Bastenne tar is sometimes fluid and sometimes solid; sometimes tar and sometimes pitch. If subject to a heatof 300 degrees it becomes a hard pitch and loses about 11 per cent. of its weight In different temperatures pitch may be tar and tar may be pitch. The presence of volatile matter is what constitutes tar, the expulsion of the volatile matter reduces it to pitch. Pitch is tar divested of as much of its volatile matter as can be taken away without a decomposition of the substance itself. This volatile matter is called oil of tar. It is not the same as petroleum, which rock oil.

Re-examined—To him the composition and operation of Mr. Claridge were new.

Mr. Phillips—A large portion of my life has been devoted to chymistry. I have lectured at various institutions, and am now keeper of the Government Geological Museum. I have been frequently consulted upon patents, and have read the specification of Mr. Claridge. It is, as far as I know, perfectly new. I contribute to chymical works, and read a great many of them, and believe the invention to be, in this country, perfectly new. The definition given by Mr. Cooper, the preceding witness, of pitch and tar, is quite correct.

In answer to a question by the foreman of the jury, the witness said that he recollected an article called "Tessera," which was used in the roofing of houses, and was composed of pitch and sand, but contained no calcareous matter whatever.

The foreman stated that he had himself used immense quantities of the article 30 years ago.

This was the plaintiff's case.

The Attorney-General addressed the jury for the defence, and contended that the particular combination for which the present patent has been granted was well known and made public in several works before the granting of the patent. In support of this assertion the learned gentleman referred to *Postlethwaite's Dictionary of Commerce*, to *M'Culloch's Dictionary*, of the edition of 1834, to *Savary's Dictionary of Trade*, and to the *Encyclopædia Britannica*. Even if the patent of the plaintiff were good there was no violation of it, as the defendant used no bitumen, but only tar, in the formation of the cement. But the patent was absolutely void according to a proviso contained in the patent itself, rendering it void as soon as it became vested in or for the benefit of 12 persons or more. Here Mr. Claridge had really no interest in the patent, as his pro-

perty in it had been conveyed to a company having a capital of 200,000*l*. in 20,000 shares, which was held by a large number of persons by whom the present action was conducted, and for whose benefit alone it was carried on.

The learned gentleman having concluded his address, the following witnesses were called :—

Dr. Andrew Ure—The combination of bitumen with carbonate of lime is not new. I saw at Broadstairs, two years ago, a walk which was composed of chalk, sand, and bitumen. The walk was not newly laid down. Pitch with sand, without chalk, has been long in use in Scotland for roofing houses. I have no doubt that chalk was an ingredient in tessera, which is quite familiar to me as a chemist. I have had extensive acquaintance with specifications. That of Claridge does not intimate that either coal tar, or mineral tar, or Stockholm tar is to be used in his process. Those tars don't range under the head of bitumen, which does not contain several sorts of volatile oil which are included in the tars. The oils may be volatilized so as to leave a residuum called pitch, but it would require a temperature of 500 degrees. Here is a specimen of tar from the City gas-works, which I have exposed to 280 degrees of Fahrenheit, but it continues tar yet, and I believe the same result would have followed if I had applied a heat 100 degrees higher. A heat of 220 degrees would be quite sufficient to cause coal-tar to unite with asphalte, and the volatile oils would not be volatilized under 316 or 320 degrees, and their presence would render the cement more plastic. The witness made a similar statement with respect to mineral tar and Stockholm tar. The difference between tar and pitch is perfectly well known in the chemical and commercial world. The asphalte of the Val de Travers contains about 20 per cent. of bitumen and tar, and is a fitter article to mix with that rich rock for the manufacture of a cement than any sort of pitch.

Cross-examined—The term asphalte has been sometimes used to signify mineral pitch, and not a composition of pitch with carbonate of lime. The pavement which Latrade put down in Oxford-street has been all dug up, as it had been put down at a shocking season of the year. I don't know any instance in which Latrade's cement, made with tar, has been used as a pavement.

The several books referred to in the Attorney-General's speech were then put in and extracts from them read.

Henry Harrison, an architect and surveyor, recollects for the last 20 years a cement called *Lord Stanhope's*. It is composed of carbonate of lime, of sand, and of tar or pitch. It has been used for terraces and roofs. Tessera was composed of the same ingredients. It was too brittle and cracked. In the roof of Mr. Nash's gallery it signally failed.

Charles Milsom, a bricklayer, has been in the habit, for 25 years, of using as plaster a cement, composed of materials mentioned in the specification of the plaintiff. It has been used at the Pavilion, at Brighton, on the chain pier, and on the roof of Buckingham-house; in the latter place to the extent of 600 squares, but was there covered with slates.

Professor Brand stated, in a few words, his concurrence in the evidence of Dr. Ure and Mr. Phillips.

Mr. Harvey, formerly superintendant of the Bastenne and Gonjac Company, saw the process of combining asphalte and tar by Latrade, when he put down the pavement in Oxford-street. Agrees with Dr. Ure in the general character of his evidence.

Fink, a dealer in pitch and tar, said that those two objects are never confounded in commerce. Sold Latrade some pitch in December, 1838 and February, 1839.

Mr. Maule, late a lecturer at the Adelaide Gallery, gave testimony in conformity with Dr. Ure's.

Mr. Webster Hockton, a tar distiller, spoke to the same effect.

A clerk of the defendant's attorney, proved a notice upon the plaintiff to produce the license granted by Claridge to the Company.

G. B. Lennard, a Director of the Company, stated that Mr. Claridge, in consideration of 8,000*l*., an exclusive license to use the patent in the United Kingdom, and that they alone had used it, and that Claridge himself had never done so in any degree upon his own account.

The prospectus of the Company stated that they had, besides the license, obtained a grant of all Mr. Claridge's interest in the asphalte mine of Seyssel.

This was the defendant's case.

Sir F. Pollock having replied,

Lord Denman charged the jury, who found a verdict for the plaintiff on all the issues of fact, but for the defendant upon the question as to the right to grant a license to more than 12 persons, with liberty to the plaintiff to move to enter the verdict on last issue for plaintiff.*

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* See the case of Protheroe *v*. May, a report of which appeared in our last week's number, and in which it was held that no kind of exclusive license vitiates a patent.

[MR.] HALL'S PATENT REEFING PADDLE-WHEELS.

[We] had the pleasure last week of inspect[ing a] pair of Mr. Hall's patent reefing [paddle]-wheels, of 14 feet diameter, which [are ab]out to be placed in a boat for the pur[pose o]f testing their operation, under the [eye of] the patentee. As we shall shortly [have] the pleasure of laying before our [reader]s a full description and engravings of [these wh]eels, we shall content ourselves with [stating] briefly that the circle described by [the pa]ddles when in action, is made to cor[respon]d with the depth of draught by making [the pa]ddles to slide upon their respective rods, and connecting them with cer[tain o]ther rods, the inner extremities of [which] move in a helical groove in a plate [fixed] to the centre of the wheel; so that [as the] latter rods recede or advance within [the gr]oove, the paddle-boards are propor[tionabl]y drawn in or protruded.

[We] have already spoken of the advan[tages] which are likely to be derived from [the ad]option of this improvement in steam [naviga]tion; but Mr. R. Clay, of Goole, a [gentle]man who has been all his life engaged [in bu]ilding steam-vessels and fitting up [engin]es, and whose opinion may therefore [be co]nsidered to be of some authority, states [the ca]se in so clear and forcible a manner, [that w]e venture to take the following extract [from his] letter to Mr. Hall, at the risk of being [charg]ed with a repetition of the arguments [latel]y quoted from the *United Service [Journ]al*:—

["I] do not think that any person, how[ever c]ompetent a judge he may be, will at [the fir]st sight perceive all the important and [extrao]rdinary advantages and consequences [that m]ust result from this Columbus's egg, [this trul]y simple invention. In the first place, [it is m]y decided opinion that a great num[ber o]f steamers now in existence, which [from] their small power are inefficient, and [from] that cause scarcely sea-worthy in [storm]y weather, will, by your improvements, [be co]nverted into vessels in every respect [comp]etent to be placed upon stations for [which] they are at present totally useless; [and I a]m quite certain that with deep draughts [of wa]ter, strong head-winds, stormy seas, &c., [your] wheels will double the effective power [of th]e engines; nay, I will be bold enough [to sa]y, that in some cases they will even [tripl]e it. I presume that no engineer will [for a] moment dispute the fact that the [amou]nt of the effective power of a pair of [engin]es is in proportion to the number of [strok]es they make per minute; I will, there[fore,] to show the benefit of your invention, [take] for example *a pair of engines*, which I [under]*stand are now constructing* for a highly respectable company, of 540 horse power, the same to make eighteen strokes per minute; now, every stroke in this instance is equal to 30 horse power: so that when the engines make only seventeen strokes per minute they are equal to only 510 horse power, when only sixteen strokes to 480 horse, and so on in proportion, however low the number of the strokes may be reduced. Now nothing is of more frequent occurrence than that such pair of engines will, from the causes above mentioned, make only nine, or one half of their proper number of strokes, they are then converted into engines of only 270 horse, or half their power. But I will go a little further, and state that I know, from the best authority, that the largest pair of engines now in operation are frequently brought up in their speed from eighteen strokes to six and a half strokes per minute, being then consequently, in the case above instanced, performing the duty of only 195 horse instead of 540 horse power; and I may remark that this reduction of power generally takes place when the greatest possible power is required to contend against the mighty power of the ocean, and enable the vessels, as will be the case with your paddle-wheels, to move in spite thereof, powerfully and majestically, away from lee shores, rocks, and other dangers, instead of such vessel paddling away, nearly in the same place for hours, without making the least progress on her voyage or departure from her impending dangers, as is the case with the deeply immersed and unalterable common paddle-wheels. That many steamers have been sacrificed by the engines becoming thus paralyzed there is not the slightest doubt, and I cannot suppose that either competent engineers or intelligent directors of steam-navigation companies, or other proprietors of marine engines and vessels will for one moment hesitate to adopt the beautiful practical remedy for the evil which you have devised. I have considered the question which you submitted to me respecting there being any disadvantage resulting from the required diminution of the diameter of the paddle-wheels to affect the objects of your patent, and I am quite of your opinion, that any one acquainted with the fundamental principles of mechanics will pronounce such a supposition to be erroneous."

PROPERTIES OF CHLORINE.

Mr. Murray delivered a very interesting lecture upon Chlorine, at the Birmingham Mechanics' Institution. Some new facts were mentioned, and others well known, were illus-

trated in a novel manner. He introduced phosphorus, and copper leaf, also mercury, at a high temperature, into the gas, which exhibited the phenomenon of spontaneous combustion. An ignited taper was also introduced into the chlorine, when it burned with a red flame, but was extinguished on being withdrawn into the atmosphere, while it rekindled, though it did not burn with the same intensity, on its re-introduction into the gas. The lecturer confessed himself unable to account for this singular fact. In some incidental observations on hydrogen, Mr. Murray noticed an experiment too often attempted with this gas, which was highly dangerous, indeed he knew of none more so. A common quart bottle was emptied, and a portion of glass tube passed through the cork, after the ingredients for evolving the gas had been cast into the bottle. The gas was then lighted as it escaped; but it was ten to one that the bottle would be shattered to atoms in the attempt, and the parties trying the experiment dangerously wounded. The gas might be taken into the lungs and respired for a short time, when it would exhibit the remarkable phenomenon of changing the voice. Reverting to the more important subject of chlorine gas, he observed that it was employed either alone, or in combination with lime or magnesia, to bleach linen or calico, and even paper, the latter not only in its pulpy state, but also after it had been manufactured. He was sorry for this, from the conviction he entertained that many valuable manuscripts, and even printed works, would ere long become a *carte blanche*. He could point to a valuable library in Yorkshire, consisting of about 30,000 volumes, collected by the proprietor at an immense cost, many of the works in which would have mouldered into dust before the lapse of half a century, from the circumstance that the paper on which they were printed having undergone the process of bleaching by chlorine; while owing to the same circumstance, many valuable deeds and documents in the country were in a fair way to destruction. His audience were, no doubt, aware that every thing now-a-days was converted into paper. He could show them specimens of paper in his own collection made from the roots of trees, from grass, from saw-dust, from husks of corn, from thistle down, from cotton waste, from potato stalks, and, to crown the catalogue, it was not many years since Mr. Mallett gravely proposed at the meeting of the British Association in Dublin, that the turf bogs of Ireland should be converted into paper. There was a curious circumstance connected with paper, the right cause of which was little suspected. It was this:—They found that the ink was always complained of, and hence they had a host of competitors offering all kinds of ink as nostrums for the evil. It was not, however, the ink that was in fault. The ink made at the present day was as good or better than ever; it was the paper that was the cause of the mischief. Let them take for instance two sheets of paper, one of good quality, the other of that description which was sold at about 4*d*. a quire. Let them write with the same ink on the surface of both papers, and they would find while one was a jet black and maintained its colour, the other became quite brown, and the paper on which it was written would shortly moulder away. Mr. Murray also mentioned the fact that sulphate of copper was not unfrequently used in making particular kinds of ink. In mending the quill pen used in writing with the ink, the sulphate seized upon and blunted the fine edge of the knife, and destroyed in a very short time the point of the steel pen. These facts, he observed, spoke for themselves. In reference to the bleaching properties of chlorine, the lecturer exhibited some novel experiments. He first wrote the word "chlorine" with common ink on a slip of paper, which he introduced into a bottle containing the gas, and the colour in the space of a few seconds was discharged, leaving the paper as from stain or mark as it was before it had been written upon. He next took a strip of blue calico, one end of which he dipped in water, (the presence of moisture being necessary to the development of the bleaching powers of the gas,) and plunging it into the chlorine, the colour of that portion of the cloth brought into contact with the water, was effectually discharged, while in the dry portion, although equally exposed to the influence of the gas, the colour remained. Mr. Murray next directed attention to one of the most important points connected with the use of chlorine,—namely, its powers as a disinfecting agent. In applying disinfecting means and measures, he contended nothing could be rationally depended upon, short of the decomposition and consequent destruction of the noxious miasm, and nothing was chemically known to effect this on the requisite practical scale but nitric or nitrous acid and chlorine. It was by this means that the Chevalier di Gimbernat succeeded in staying the plague in Andalusia in 1801. By the admixture of nitric and muriatic acids chlorine was formed; it might also be liberated from the chloride of lime or soda by the addition of sulphuric acid; heat, in these cases, would render the evolution of the gas more complete. For the use of families, where typhus or scarlet

prevails, Mr. Murray recommended
llowing simple method, which he be-
would prove effectual in staying the
ess of infection. To a tea-cup, con-
g a small quantity of peroxyde of man-
e, a fluid ounce or more of muriatic
should be added. These ingredients
l then be mixed by means of a rod, or
ther substance, not metallic, when the
ad its contents should be placed in a
plate containing water about milk
. This might be placed in some con-
nt angle of the room of the patient, or
assage leading to it, and if that was
l too powerful, a saucer or plate laid
he cup would be all that was required,
the power of the gas might be in-
d at pleasure by removing this tem-
y covering, or adding fresh portions of
or of oxyde.

IDGE'S PATENT ASPHALTIC MASTIC COMPOSITION.

s invention consists in the combination
at of two substances into a mastic ce-
or composition: one substance being a
al compound, consisting principally of
nate of lime and bitumen, with a small
n of aqueous and other matter, and
only known by the name of *asphalte* or
ltos or *calcareous asphalte*, *asphaltic*
al, or *asphaltic rock*, or *asphaltic*
It is found at Pyrimont, near to
el, in the department De l' Ain, in the
om of France, and in other parts of
ra Mountains, and in other places, in
abundance. The other substance is
en or mineral or other pitch. To make
omposition the patentee directs you to
ed as follows:—Take the asphalte in
tive state, as it is extracted in masses
the mine, and reduce it to powder; it
e reduced to powder solely by mecha-
means, but the process is facilitated by
by placing the masses in a furnace or
the bottom of which is made of plate-
in about half an hour, by the applica-
f a brisk fire, the asphalte falls or is
y reduced to powder. The asphalte is
passed through a sieve, the meshes of
are about one-fourth of an inch square;
hen in a fit state to be mixed with the
en or mineral or other pitch. The
en is freed from its extraneous mat-
the ordinary way.
e about ninety-three pasts of asphalte
ed to powder, and passed through a
as directed, to about from seven to ten
of bitumen or mineral pitch. The
lty of bitumen intended to be used is
laced in a melting cauldron or furnace,
hen it is *dissolved the powdered as*-phalte is added gradually; the mixture is kept carefully stirred in order that it may not be burnt, and also that the asphalte and bitumen may be perfectly amalgamated. The mixture is kept over the fire, carefully stirred, until the whole is thoroughly combined and is nearly fluid, and then kept over rather a slow fire until the mixture is nearly in a state of ebullition, it then gives out a light white smoke in jets, and it is fit for use. When other asphalte is used, instead of the asphalte of Pyrimont, the quuntity of bitumen to be added, will vary according to the particular nature of the asphalte, and the proper quantity will easily be found by trial. When bitumen or mineral, or other pitch than that from the neighbourhood of Pyrimont is used, the precise proportion will easily be determined also by trial.

In applying the cement or composition to paving, add to about every 200 pounds weight of the nearly fluid mastic cement, about half a bucket full of very small, clean, and hot gravel or sand; this is carefully stirred up with the mastic, and as soon as it is sufficiently fluid, that is, as soon as the mastic begins to give out the light white smoke previously described, it is fit for use. It may then be run into moulds, and remain until cold, when it will form blocks or slabs, which may be laid upon any proper foundation. These blocks or slabs are cemented together by pouring the fluid mastic cement between the interstices of the blocks or slabs. Sometimes a thin coating of mastic cement is spread over the foundation, and the blocks or slabs are imbedded therein, in such case the cement is also poured in between the interstices. If it be desired that the pavement should be ornamented so as to represent mosaic or other work, the process of forming the blocks or slabs is as follows:—

First, a large flat surface is formed, either of wood or plaster, upon which the required pattern is drawn. This surface, or a portion, is enclosed with iron bars of the intended thickness of the slab; over this surface, a thin coat of transparent glutinous size is spread; as the following work advances, pebbles of various colours, pieces of porcelain-ware, earthen-ware, glass, or other materials, of the required forms and colours, are deposited upon their allotted portions of the patterns, either to represent foliage or fret-work, or any other device. By means of the weak size, they are very lightly retained in their places, and the mastic cement or composition, either mixed with fine gravel or sand, or unmixed, is poured into the space enclosed with iron bars. This mastic cement or composition fills up the interstices between the pebbles, pieces of porcelain-ware, earthen-ware, glass, and other ma-

terials, and forms with them a hard slab, the bottom thereof being the surface or part to be exposed. The slabs thus formed are cemented together in the same manner as before directed.

To form ways or paths proceed thus. Upon a proper foundation place two flat-iron bars parallel to each other at a convenient distance from each other, say, from three to four feet—these bars are of the thickness to which the mastic cement or composition is intended to be spread, usually about half an inch thick; between these bars, the fluid mastic and fine gravel or sand is poured and spread, and the surface made regular and uniform by passing a thick piece of wood, with one straight edge, backwards and forwards upon the iron bars. Upon this surface, whilst still in a semi-fluid state, sift fine hot gravel, which is to be beat into the mastic with wooden stampers. When the mastic is set, the operation is repeated until the surface required for the way or path is covered. As the operation proceeds, the surface of the cement already set, renders the use of the iron bars unnecessary.

For road-making, superficially; upon the surface of a road formed of the usual materials, in the usual way, and the bottom of which has undergone the usual preparation, pour mastic cement or composition thereon, either with or without fine gravel or sand, heated just so as to give out the light white smoke, and it then forms with such stones, a hard and compact surface; or another way is to apply the mastic cement under the hard materials, and in which case spread a thin coating of the cement, either mixed with fine gravel or sand, or not, between the substratum and the hard materials, for the purpose of preventing the hard materials being injured by the land-springs.

In applying the cement for the purpose of covering buildings; cover the roof with canvass, similar to that used by paper-hangers, stretched tolerable tightly, and upon this canvass spread a layer of the fluid mastic cement, to about the thickness of four-tenths of an inch, and upon the surface of the mastic, when the same is in a semi-fluid state, sift gravel previously heated; and, as the mastic sets, beat the gravel into the surface of the mastic with flat wooden stampers, about fifteen inches long and nine inches broad, until the gravel is incorporated into the substance of the mastic.

The process of applying the mastic to the lining of tanks, reservoirs, and other similar purposes, is very similar to that previously described. In such linings, no gravel or sand is used with the said mastic, but a coating is applied whilst the mastic is of the heat, when it just begins to give out a white light smoke. For the bottom surface of tanks or reservoirs, a simple covering of the mastic is sufficient; for the sides of such tanks or reservoirs, the face of each brick which is intended to be inwards and exposed to the water, is first covered with a thin coat; this is done by laying the bricks side by side on a level ground, as if they were to form a pavement, then the fluid mastic is thinly spread over their whole surface; as soon as it begins to set, which is in a few seconds, and before it becomes hard, the blade of a large knife is passed between the bricks, cutting the mastic through, at the same time the process leaves each brick with one face covered with the mastic cement. This done, the walls or sides of the tanks or reservoirs are built, and each brick is set in fluid mastic, instead of calcareous mortar or cement; and for greater security a space of about half an inch is left between the inner and outer bricks, which form the side-walls of tanks or reservoirs: this space is filled up with the fluid mastic, as the brickwork advances; this is the process usually adopted.

NOTES AND NOTICES.

Daguerreotype.—M. Arago has lately communicated to the Secretary of the Academy of Sciences at Paris, some photogenic representations of the principal buildings of Rome, made with the Daguerreotype, by one of the workmen of M. Lerebours, the celebrated optician, sent thither for that purpose. M. Arago remarked that this was a proof of how little the apparatus in question stood in need of being invariably placed in the hands of a man of science. The views were very distinct and beautiful.

Death of Mr. Oldham, C.E.—We regret to have to announce the death of this ingenious mechanic and talented engineer, on Friday night, the 14th instant, of internal hæmorrhage. Mr. Oldham was engineer of the Bank of England, having previously held the same office in the Bank of Ireland. All the beautiful and complicated machinery used in both establishments for the preparation of the plates, the engraving, printing, numbering, and other operations connected with the manufacture of the notes, were designed and executed by him, and evinced a first-rate genius in mechanical computation and combination. Mr. Oldham has left a very numerous family, no less, we believe, than seventeen children. His eldest son now holds the office of engineer to the Bank of Ireland.

Egypt.—Machines have been brought from England to drain the marshes at Alexandretta, where the stagnant waters fill the country with malaria. The same cause propagates fever in the Egyptian army at Marasch, Adana, and other places. The hospital service is very badly arranged.

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lo. 864.] SATURDAY, FEBRUARY 29, 1840. [Price 3*d.*

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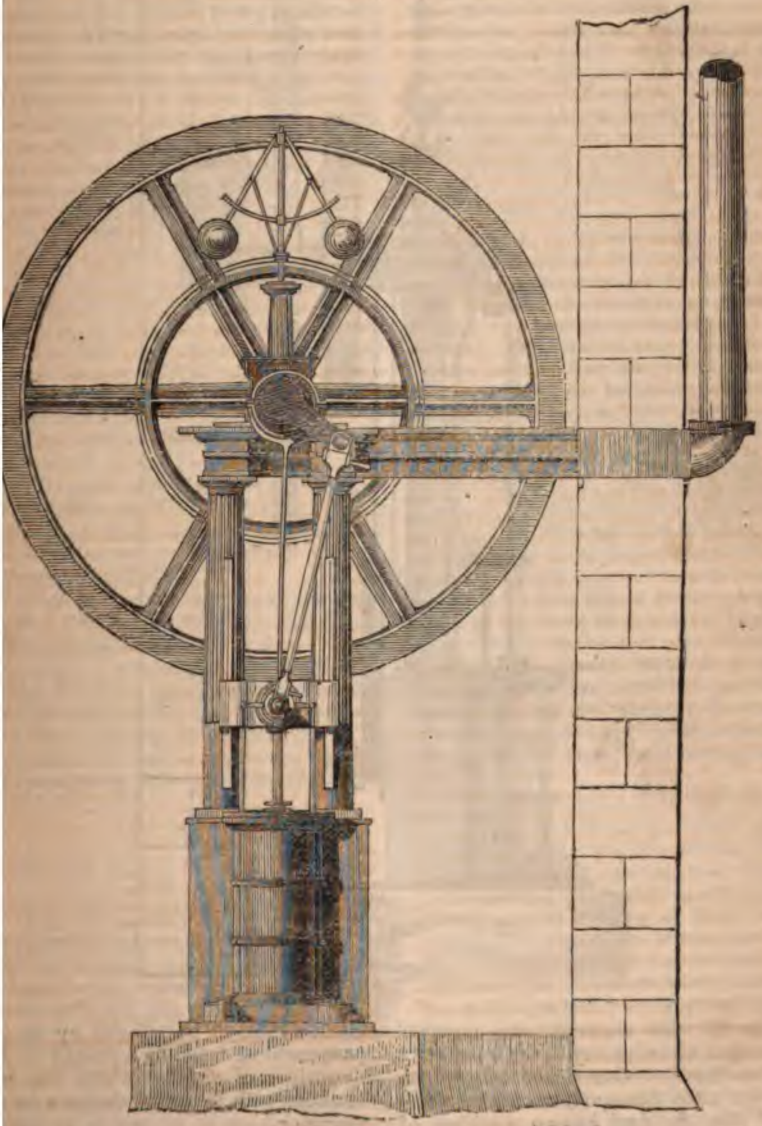
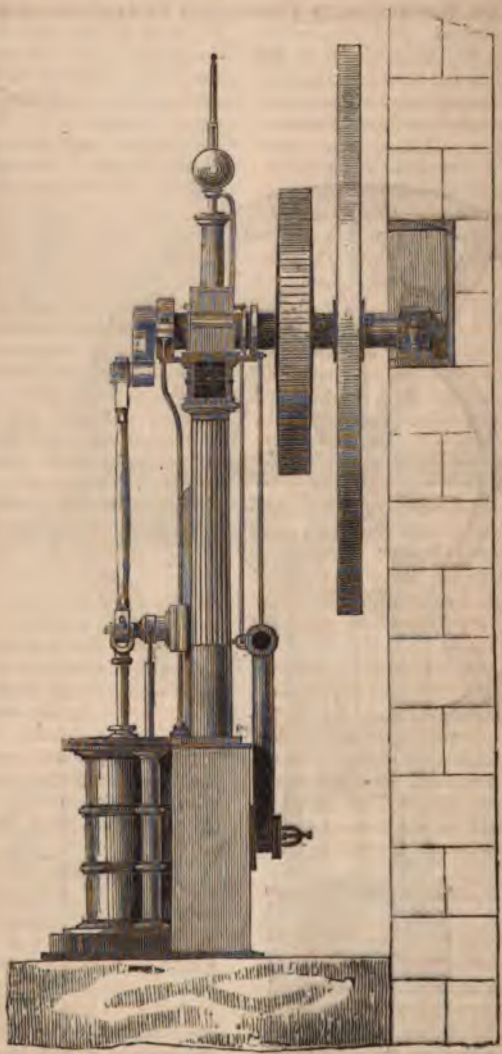
THOROLD'S REGISTERED IMPROVED STEAM-ENGINE FRAME.

Fig. 1.



THOROLD'S REGISTERED IMPROVED STEAM-ENGINE FRAME-WORK.

In the evidence which was adduced before the "Select Committee of the House of Commons on the Arts and Principles of Design," it was shown that the most beautiful forms could be combined with the most scientific applica-



tion of the material, as regarded strength and economy in the frame work *of machinery*. One witness of good authority, (Mr. Nasmyth, of Manchester) *stated that* he had known a saving of about a third to be effected by an improvement of form, by a change in the disposition of material, which was also attended with increased elegance in appearance.

It will be found that machines when first invented have seldom any beauty of form; the mechanic is too much occupied in contriving and placing the parts so as to accomplish the desired movement, to think of symmetry or elegance of arrangement. When, however, the machine has been perfected, and its action in performing its destined office delights the mind of the inventor, then the designer steps in, moulds the parts and general arrangement into forms possessed of external beauty. The inventor helps in this too; as he studies, he simplifies, and simplicity is always companion to grace. The steam-engine itself is a striking illustration of these remarks; compare the straight and crabbed angular parts of the machines of a Newcomen or a Watt, with the simple and beautiful designs, in which the same power is embodied, of the productions of a Seaward or a Maudslay!—and particularly with the neat and compact form represented in our front and third pages, and the registration of which has led us to these observations.

Mr. Thorold's (of Norwich) design for a steam-engine frame (Jan. 27, No. 239) is, we believe, the first of that kind upon the Registry of the Designs protected by the Registration Act, which was passed in pursuance of the recommendation of the Parliamentary Committee we have above referred to.

Fig. 1, on our first page, is a front view of an engine and framework after Mr. Thorold's design, and the figure opposite, is a side view. It will be evident that this engine could be erected in a very small space, and, in consequence of its simplicity, be economical in its construction, and, at the same time, no advantageous principle is sacrificed.

ON THE CAUSE OF STEAM-BOILER EXPLOSIONS.

Sir,—All the writers on steam-boiler explosions appear to have either forgotten or not to have been aware of one, if not the principal, cause of them. Persons accustomed to the operation of heating any liquid in close vessels, know, that under a considerable pressure, the intumescence within the boiler, in the *bubbling up of the liquid*, is checked to *such an extent as to render it nearly* motionless. Now let us see in what state water exists in steam-boilers with a moderate pressure on the valve. Steam and water is then in a state of intimate admixture throughout the whole mass, and the former is ready to escape, not only from the surface, but from all parts of the body of the water, on the removal of the pressure. In this tendency to escape, the steam of course cannot rush to the surface but by carrying with it a considerable mass of the water (which surrounds and imprisons the steam) to a certain height. We will, therefore, now suppose that the pressure in the boiler is sufficient to raise the valve a little—the spring of the steam within instantly occasions a violent ebullition, and whilst there is sufficient vacant space in the boiler above the surface of the water, so that the bubbles of water may break and set free the imprisoned steam before they fill completely the vacant space or touch the valve, it may admit an escape of the steam in sufficient quantity to carry off all the caloric which the fire underneath is supplying to the boiler every moment of time—but suppose the ebullition to become so violent on the raising of the valve as to project water and steam together through it, what is the consequence? As it is well known that steam issuing from any aperture will carry off 1000 degrees of heat, or nearly five times as much as water in similar circumstances, if the valve does not, in such an event, open to five times the space it did before, in proportion to the quantity of water, (mixed with steam) required to pass through it, the heat must accumulate in the boiler, and the pressure be consequently augmenting, notwithstanding the valve is acting, until an explosion ensues.

Thus what appears to be a paradox is certainly true, that a valve which might be quite safe by a partial opening would become unsafe by a greater one—that is, whilst *steam alone* is passing through it, a much greater quantity of caloric is escaping than when, by a greater opening, the ebullition should be so increased as to raise the water also, and thus partially choke the aperture. It therefore follows that it is dangerous to allow a valve to open too suddenly and widely, and that it is much safer to put such a stop on it, as will so regulate the aperture that the ebullition within the boiler shall be re-

strained to the extent of not mounting so high as the valve, the lift of which, necessary for this purpose, depending as it does on the form of the boiler, the pressure at which it is worked, and the quantity of water in it, can only be ascertained by experience.

H. A. M.

Bristol, Feb. 20, 1840.

IMPROVEMENTS IN LIFE-BOATS.

Sir,—Having seen in your last month's journal, a notice of alterations in life-boats, from the Report of the Cornwall Polytechnic Society, I beg leave to offer a few observations thereon:—

First, of Adams's. It is said that this boat has two bows, (four, I suppose, as both ends are alike) and that the men, by merely turning themselves on the thwart, and shifting their oars to another thowl, are capable of immediately pulling in an opposite direction. Now, these advantages are not peculiar to Mr. Adams's life-boat, they are found in the first boats constructed by Mr. Greathead, at least with a very slight alteration, or rather improvement, in the change of direction; the oars, by his arrangement, remaining on the same thowl, and the men shifting to another seat. The dimensions of boats now built on Mr. Greatheed's principles, are much the same as those recommended by Mr. Adams. It is also said that the half-breadth line is the segment of a circle, which I consider is far from being the most suitable form, as her greatest breadth being only in the middle, would not only cause her to pitch and jump very much when going end on to the sea, but also render her more liable to upset, by taking away the support from the water-line between the middle and ends, and presenting a more direct surface to the action of the sea on the weather bow, when going in that direction.

The air-tight vessels at the ends are not new, and are found to obstruct and interfere with the steersman, when discharging the duties of his office; and if they raised not rose considerably above the middle of the boat, their assistance in righting her when upset is certainly very trifling; and which height renders the danger of upsetting much greater.

It appears to me too, that this boat is in constant danger of being water-logged, and consequently almost unmanageable, as there are no means for her to empty herself; and with such a small crew, any of them could ill be spared to bale the water out. I consider that the cork and air-fittings have a very small tendency, if any, to prevent her being turned over, and venture to predict that she will not right herself when in that position.

The description of Phillips's life-boat is not sufficiently clear to make many remarks upon, but a similar opinion with Mr. Phillips, I have for some time past entertained, respecting the air-bags and iron keel, though I intended to have an air-*box* in the room of bags, to run along one side. It is quite evident that a boat filled in this manner would immediately right herself, though only one way; but then comes the inconvenience of a heavy iron keel. As these boats have generally to be launched from a beach, it would be almost impossible to get them off, by having so great an increase of weight to contend with; and the danger of staving, when boarding a vessel, would also be greatly increased by the momentum acquired by the boat and keel. As the act of rowing is generally considered the best application of human power, I think it would be improper to transfer it to any mechanical arrangement, in the form of paddle-wheels or Archimedian screws.

As this communication has already extended to a greater length than I originally intended, I must conclude by saying, that if you, Sir, deem this worthy of a place in your valuable journal, I shall at a future time, suggest a few improvements in Greatheed's life-boat, and at present subscribe myself,

Your most obedient servant,

B.

Scarborough, Feb. 21, 1840.

MINERS' SAFETY ROPES.

Sir,—In No. 860 of the *Mechanics' Magazine* there is a sketch of a method suggested by Admiral Bullen, of using a safety rope of the same diameter as the working rope, by which the men are suspended in ascending and descending mines; and from which I should judge that the gallant admiral has but a very limited acquaintance with the working of mines. It seems to me that it would

be a simpler plan, and one which would only occasion the same cost, to use the simple rope for only half the time it is now usually employed as a working rope; both as more convenient for coiling on the cage or barrel, and less expensive in respect to engine power, reference being made to the great proportion the weight of the extra safety rope bears to the weight of the men lifted in deep shafts. If a similar cost were allowed, I should prefer its being expended on a little additional strength to each rope, as absolutely safer than the use of a safety rope.

The best security against danger, I conceive, is to throw the responsibility of keeping the rope in good order on the agents of the mine; and on the owners, of providing a sufficient supply. Taking the contrary supposition—an absence of care and attention on the part of the agents of the mine, and neglect on the part of the owners. The safety rope would be kept in its place until it was rotten, and the working rope would be continued in use until it broke, and then the decayed safety rope would be found to be no protection.

No blame could in such a case be attributed to parties using the safety apparatus; as for the men, persons who have commanded seamen must be aware of their insensibility to habitual danger.

Preventer-braces are good for fighting, and preventer-shrouds are good in bad weather in distant seas, where every rope must run to the uttermost. At home I conceive it is true economy and more conducive to safety, not to require too long a service from each rope. I should feel obliged to any of your readers if they could supply further information respecting the wire ropes recently introduced in several German mines, of which a favourable account was given in 1838, by Count Brenner,* (the director of the Austrian mines) the trial had been made at that time.

I remain, yours truly,

E.

IMPROVED HOT-HOUSE BOILERS.

Sir,—I cannot perceive in what consists the great advantages proposed to be derived from the use of the boiler recommended by Messrs. Williams and Co., as described in No. 840 of your Magazine, in the heating of hot houses and similar erections. If it be intended to place the boiler with its flat projecting top exposed within the structure to be heated, for the purpose of diffusing the greatest portion of heat in that particular spot, the boiler is well designed, but if we should require the greatest effective portion of heat from a given quantity of fuel, and a machine that would distribute heat in an equable manner through every part of the building to be heated, and a boiler of the best form for an effective and rapid circulation of the water, I think the one under consideration is in many points defective. It is stated, that an apparatus constructed with this boiler, would be economical in the consumption of fuel; to attain this desirable object the shape of the boiler ought to be such as a flue would readily pass round, so as to expend as much heat on its surface as possible; the shape of Messrs. Williams's boiler appears to me, to be ill calculated to afford this, a flue cannot with any propriety circulate round that form completely, and if the flue be not intended to circulate, but merely pass under it, much heat will be lost and pass directly into the chimney, which would be a great defect, for where only a small surface is exposed to the action of the fire, the heat there must be more intense to ensure the same effect that might be produced, with a less fire, on a boiler, more of whose surface was exposed to the fire. The return pipe is, I conceive, placed on a very objectionable part of the boiler, being near the throat of the fire place where the greatest draft will be, and of consequence the greatest heat, this would in some degree alter the weight of the descending column of water, and thereby lessen the velocity of the circulation and diminish the power of the apparatus. The return pipe should enter the boiler at that part, least likely to be effected by the fire, for the above reason. The "flow" or "rising" pipe on Messrs. Williams's boiler is injudiciously placed, few of the heated particles will enter it, but those that are heated immediately under it, the rest having to struggle in a horizontal direction for nearly the whole length of the boiler before they can reach the opening for their exit, contrary to the law that governs

* See Mech. Mag. vol. 29, p. 471.

them, by which they are when heated, impelled upwards and not horizontally. The internal shape of the boiler should be such as to conduce to the easy ascent of the water and be a guide to the natural upward movement of the heated particles. I imagine too that the natural action of the water will be deranged in getting to the top of this boiler by a current of colder water from the return pipe making its way over the top of the arch of the boiler to get at the lowest part on the other side, this it must do, or a secondary circulation will take place in the upper pipe, because of the colder water which would be carried into it by the ascent of the heated portion, this would neutralize the working of the apparatus altogether, unless the ascending and descending columns were of a considerable height. If then the boiler be as I think, defective in its shape externally for the free passage of the flue, and internally for the proper circulation of the water; if it be defective in point of economy of fuel, and deficient in effect, it does not in my opinion possess any thing to recommend it, with one exception. The projections and moveable flanges for cleaning out the boiler are decidedly good.

I beg leave to hand you a sketch of a boiler I saw in use; it answered its purpose remarkably well in heating a pine house, and is, I think, of the best form I have been able to discover.

Fig. 1.

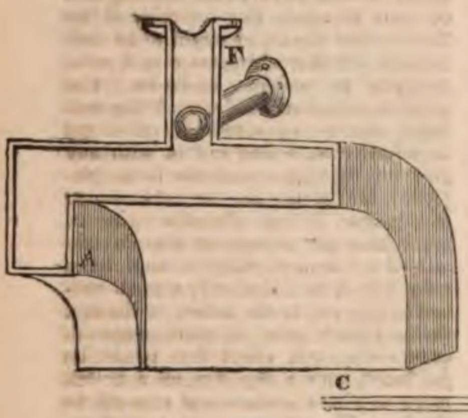


Fig. 2.

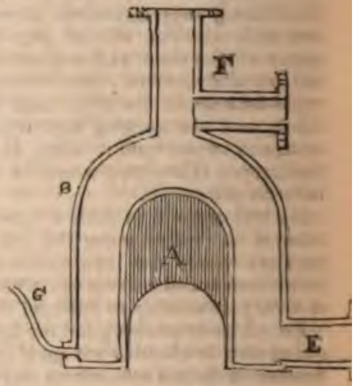


Fig. 3.

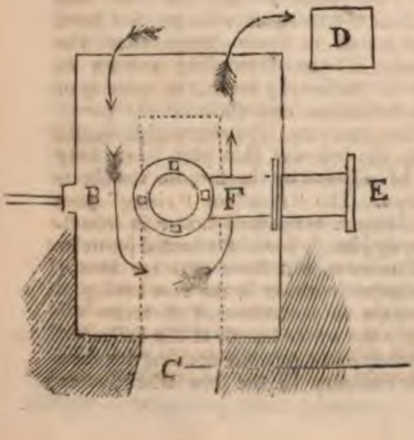


Fig. 1 is a longitudinal section of the boiler I refer to; fig. 2, a cross section, and fig. 3 a plan. The flue passes from the fire place C, under the part A, where the internal arch of the boiler is depressed, and the flue space contracted, at the back of the boiler, which keeps the heat from too rapidly passing from under the boiler, this depressed part is only so, for about six inches in length of the boiler, the flue then comes out at the end of the boiler, and returns at the side B (see plan) along which it runs, then, over the top or crown of the boiler, and down the other side, from which it passes into the chimney D; thus making the circuit of the boiler, excepting the front end. For this beneficial expending of the heat on the boiler it is well shaped, it may be set outside of the building to be heated entirely,

no part of it is seen, being quite concealed in the brick work, the object being to diffuse the heat, not from the boiler externally, but from the pipes connected with it. The return pipe E is placed low on the side where it enters the boiler, without being acted on by the heat before it does so; and here will be seen the great utility of the depression of that part of the back of the boiler before noticed, the cold returned water passes *in* it, from that side of the boiler at which it enters to the other side without at all injuring the ascent of the heated portion, thus the colder water becomes well scattered in its proper place, the the lowest point of the whole apparatus, and leaves the higher parts of the boiler perfectly free for the flow of the warmer water as it rises. The flow or rising pipe F, as you perceive (see fig. 2, cross section) is at the crown of the internal arch, occupies the best possible situation, and forms the natural easy outlet for the circulating medium which is guided to this spot without constraint or attempting to turn it out of its course. G is the feed pipe. This boiler (which I hope I have clearly described) is in my judgment well formed both for the easy traverse of the flue, outside, and for allowing unimpeded the operations of the water inside; it is strictly economical, and very efficient, the best I have yet seen. I perhaps have not duly appreciated the merit of Messrs. Williams's construction, but am not so wedded to my own way of thinking as not to be free to change, if they think well by some further elucidation to try and make a convert of,

Your much obliged obedient servant,
AN IRISHMAN.

Cork, January, 23, 1840.

COOKE'S IMPROVEMENT IN ARGAND GAS BURNERS.*

In the common Argand burner the holes in the top through which the gas issues for combustion, are perforated *vertically*, and consequently the flame rises perpendicularly from the burner. Mr. Cooke's invention consists in drilling or perforating these holes at any convenient angle, twenty, thirty, or sixty degrees from the axis of the burner. He states the advantage to be derived from the change of position to be this; that the gas being forced through the holes drilled at the sides of the burner, instead of through holes at the top of it, passes into and through a larger portion of atmospheric air, obtaining a larger portion of oxygen, and necessarily possesses a greater illuminating power, than when burnt with common Argand burner.

* Patent granted to Benjamin Cooke, of Birmingham; "an improvement in gas burners, commonly called, or known by the name of Argand burners." Dated Dec. 9, 1837; specification enrolled, June 1838.

ELECTRO MAGNETIC ENGINES.

We have just received from New York the second number of a newspaper, bearing the title of the *Electro Magnet, and Mechanics Intelligencer*, bearing date the 25th January, 1840, published by Thomas Davenport, containing the announcement that it is *printed on a press propelled by electro magnetism*. The paper contains no account of the machine, but we presume that it is the same which was described in our 27th and 28th volumes (particularly in No. 758). In November, 1837, Dr. Jones, the Editor of the *Franklin Journal*, stated that Mr. Davenport was then occupied in constructing an engine intended to drive a Napier's printing-press requiring a two-horse power. Although he has been long in completing this engine, we are still gratified to know that he has been at length successful. Of the truth of the statement that electro magnetism was the power by which the paper was printed, we apprehend there can be no doubt, as Mr. Davenport invites the public of New York to come and see the machine working the third number of the *Electro Magnet*, which he announced would be published on the 1st of February, as will be seen from the following extract:—

"The first number of the *Electro Magnet* was issued on Saturday, January 18, 1840, which was the first paper ever printed by the power of electro-magnetism or galvanism. The project was proposed and set on foot for the express purpose of bringing before the public some tangible illustration whereby the power might be brought forward upon as cheap and prudent a scale as possible. How far we have succeeded time must show. With this number we make our second appearance, although not so regular as might

be supposed, or at all events wished. Our third number will be issued on Saturday afternoon next, Feb. 1, at which time we shall be in operation, and any person who may wish to see the machine, may do so, by calling at our office, 42, Stanton-street, a few doors from the Bowery.

"The question having been so often asked, 'why don't you apply the machine to this or that,' or anything that they, in their wisdom, might fancy, all of which we have duly considered. Therefore, in following our own inclination, we have commenced as our judgment dictates, and now offer to the public our plan for operation. As the second number of our publication is before the public, we would respectfully call the attention of those who would wish to advance the cause of philanthropy to come forward and assist us in our experiment. That we may be considered chimerical by many we doubt not, but when all things are fully proved we shall hope for a better fate than many of our predecessors."

It will be observed that Mr. Davenport asserts this to be "the first paper ever printed by the power of electro magnetism or galvanism." We believe Mr. Davenport to be a man of probity; but what are we to think of his countrymen (not friends, but rather enemies, for there could be no more certain means of injuring the cause of science, particularly on this point, than the utterance of falsehood as to the results of experiments) who stated, in August, 1838 (see *Morning Herald* of the time, and *Mechanics' Magazine*, No. 784, p. 336) that they had "witnessed a two-horse power electro-magnetic engine of Mr. Davenport's, employed in printing a newspaper in New York, and that it performed its work satisfactorily!"

IMPROVED PRINTER'S COMPOSING STICK.

Sir, — From the commencement of printing to the present day, the composing stick has retained the nearly same shape and form of construction. That such has been the case is rather surprising, considering the many improvements which have been made in presses, and other materials in printing, and the many accidents to which the composing stick is liable; the back, or flanch, being in many instances so thin as to be easily *bent by the fingers*; while the least fall or *other accident* may so derange it as to render its "justification"* untrue. Such being the case, has induced me to construct a composing stick, on a somewhat different principle, as shown by the following figures.

Fig. 2. *Improved Stick.*

Fig. 1. *Common Stick.*

* Keeping the lines of type of exactly the same length.

It will on first sight be seen that the great advantage it possesses over that of the old construction, is its being more simple in make, and of greater durability. The back being much stronger, and fastened by rivets similar to the head, and having an opening to admit the tenon of the slide, which receives the screw. Not to have the opening larger than necessary, I leave out the centre of the tenon, that the screw may be the full size. Thus, instead of taking the screw entirely from the nut, and removing it to another hole, as is often the case, it is merely required to be loosened, and the slide may be removed the required distance with ease. As a compositor, I have used, and can with confidence recommend this invention to my brethren.

J. H. LEWIS, 197, L.—L. U. C.

CURTIS'S PATENT APPARATUS TO TAKE UP CARRIAGES WHILST THE TRAIN IS AT FULL SPEED.

Sir,—I beg to hand you for publication in your Magazine the description of a plan I have patented, by which an additional carriage may be taken up and attached to a train without stopping the train.*

Fig. 1.—Side view.

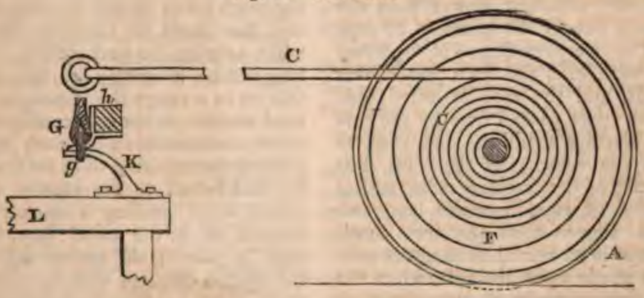


Fig. 2—Front view.

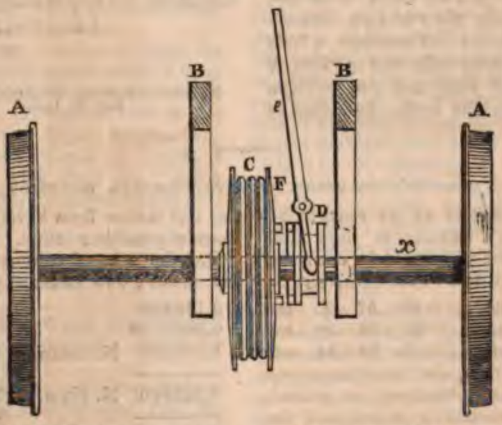


Figure 1 is a side view and section, and fig. 2 a front view. A, is the fore wheel of the carriage to be taken up, and x the axle; upon the axle is placed the sheave F, within which coils the rope C; the sheave runs loose upon the axle, and

* The suggestion of a plan in some of its parts somewhat resembling this of Mr. Curtis's was published in our 30th vol., p. 133, by a Cambridge correspondent, who signs himself "G. R."

is thrown in and out of gear with it by the clutch D, worked by the lever *e*, the end of the rope is made fast to the sheave, and the rope coils over itself. The rope may be of any convenient length, about 100 yards I consider sufficient. B, B, are two supports depending from the framing of the carriage to support the axle more steadily. L, is the framing of the last carriage of the train, to the side of the framing is fixed the hook K; a post *h*, is placed at a proper distance, upon which is fixed the hook or bolt *i*; the ring *g*, fastened to the end of the rope *c'*, is then hooked up on the bolt *i*; the hook *k*, of the passing carriage hooks into the ring and carries away the rope, which then drags the carriage to which the pulley is attached along with it; but the carriage is dragged after the train by a velocity so much slower than the train, as is due to the quantity of rope uncoiled for every revolution of the wheel A; for example, if the train passed over five yards, and the rope uncoiled four yards, the space passed over by the carriage at starting would be one yard or one-fifth the velocity of the train, but the velocity of the carriage is increasing as the coil of rope becomes less, and it moves slower than the train until all the rope is unwound, then afterwards the rope winds upon the axle, when the carriage then moves at a greater velocity than the train, and in the same proportion as the rope coils up when it at last overtakes the train, then when it has arrived close up to the last carriage, a bolt is fixed into the drag link, and the clutch is thrown out of gear, and the carriage is then united to the train the same as the rest. In this instance the sheave and apparatus is applied to the carriage, but it may likewise be applied to the engine or tender, and the best place to fix it would be outside the wheels, lengthening the shaft, and hanging the sheave upon it; and as regards the operation of taking on the coach, the link or ring *i*, of the rope will hook into the hook K, instead of the ring into the hook as before described; and the rope C will coil round the reverse way to that shown in the drawing. The carriage is of course placed in a siding, and it enters the line by a switch in the usual way.

This apparatus will be useful in cases where it is desirable as in the mail train, to take up passengers, &c. without stopping, and also to communicate with more points along the line than at present; the coach taken up will be always the last, and this must be likewise thrown off when nearing the next station. The arrangements necessary for this operation will be to arrange the passengers for the road stations in the last carriages, which must communicate with each other, the passengers requiring to be set down must be transferred to the station carriage, which, when nearing a station must be thrown off in the usual way, then the train in passing the station will take up the station carriage with its passengers, these must be then transferred to the train, and the operation may be thus continued for any number of stations.

I am, Sir, &c.

W. J. CURTIS.

15, Stamford-street, Blackfriars Road.
Feb. 24, 1840.

NAUTILUS'S SOLUTION OF ASTRONOMICAL QUESTION.

Sir,—In continuation of my remarks on Mr. George Scott's solution at page 332, will you indulge me with space for one more method by which it will be seen that Mr. S. was still farther from having discovered the shortest possible solution.

For the sake of comparison I shall use Mr. Scott's own values at page 272.

Lat. Edin....	55	57	23	tan...	0.170300		
Do. London..	51	28	39	cot. ..	9.900955*		
Diff. Lon....	3	10	54	cosec..	1.255691	N. Cotan...	179894
					1.326946	N. Num...	212298
Hour Angl...	107	9	2	cosin..	9.469651*	N. Tan....	32404
Declin.......	13	12	31	tan. ..	0.370606		

If this method be subjected to the same test as the others at page 332, it will be

* The two logs with the stars to be added together.

found that the "total number of operations" does not exceed 25! while three auxiliary angles introduced by Mr. Scott, with the necessary operations upon them, are entirely done away with.

NAUTILUS.

SUBMARINE ILLUMINATION.—THE "ROYAL GEORGE."

[To the Editor of the *Morning Chronicle*.]

"He made darkness his secret place, and his Pavilion round about him of dark waters."—*Book of Psalms.*

"Hunt Nature into her Elements."—*Akenside.*

Sir,—At the same time that I express my obligation for your courtesy and kindness in publishing the letter which I addressed to you, on the value of the power of generating artificial illumination of the parts in succession, when the whole cannot be illumined together, of objects submerged and invisible in the deep darkness of muddy water (like that in which the wreck of the *Royal George* lies at Spithead), I beg that you will honour me by accepting the number which I send you of the *Morning Chronicle*.

Its date is the second of last November. On the night of the 31st of December, near two months after, I made a descent at high water, in about seven fathoms, in Kingstown Harbour, near Dublin, where courses of granite blocks are laying for the foundation of the intended light-house; and when at the bottom, I made a vessel of the sea-water deeply dark, with an intermixture of common puddle, and of trampled wet coal-dust, which I scraped up from before the gate of the store built for the use of the steam-packets, which stands on the eastern pier.

I then immerged in that murky water the copy of the *Morning Chronicle* which I send you, and which, of course, became then as utterly invisible as if it were placed at the Antipodes, or the very Nadir; but the moment I chose that it should be visible, it suddenly glanced forth from its "secret place" in "darkness," in powerful and permanent irradiation.

The power of the light, and the permanency, both entirely dependent on my will. The light may be a radiance, or it may be

——————————"pale and wan,
Like watch-light by the bed of some departing man."

It is entirely under controul in respect to intensity and duration.

The divers whom I brought down with me then, to their great astonishment, read my letter to you, thus highly illumined and gleaming in "amber light," but at the same time submerged in water, which was (to use the words of one of themselves) "a hundred times blacker and more muddy than any they could ever *expect to have occasion* to work *in while they lived.*"

Thus, sir, while reading the letter, they were reading the enunciation of the theory of the process of illumination by which I gave them the power of reading it; and this, I submit, was final and decisive verification of that theory by the test of actual experiment.

I treat with derision all theories, until confirmed by experiment. It has been inimitably said, that "*the Devil has invented practice to contradict theory.*"

I have mentioned that the copy of the *Morning Chronicle* which accompanies this letter was the object which I illumined, and I hope the editor of that noble journal, in which it was first published will not refuse to inspect it, and to accept it from me in friendly reminiscence, as it was by its irradiation—*its wn actual irradiation*—that the theory in optical science which in its columns I first gave to the world for the use of divers, was decisively established by rigorous experiment, viz., in a dark December night, and at the bottom of the sea.

I take occasion, however, to observe here, that night and day would be perfectly alike in this case, without the process of illumination which I had recourse to; for neither

"The deep blue noon of night, lit by an orb
That looks a spirit, or a spirit's world;"

nor the roseal sun-blush of the roseate "incense-breathing morn;" nor the "piercing ray" of the oxyhydrogen gas-light; nor the gorgeous torrid glory of the tropic meridian "arch-chemick sun," could penetrate a quarter of an inch of that darksome water, so as to cause any substance immersed in it to be perceptible by human vision.

My excellent and long-proved friend, Mr. Robertson, of whose high approbation of the principle of illumination I am very proud, has, in an editorial article, stated his intention of publishing in the *Mechanics' Magazine* an engraving from the diagram which I drew for him of the combination with the diving helmet of the instrument of my invention.

It is by its adaptation to the diving helmet, worn with the water-tight dress, which affords such facility of loco-motion under water, that I expect that this new principle of subaqueous irradiation will be found to yield to divers in their operations its maximum of utility.

My ardent aspirations are to endeavour, by habits of most patient meditation and observation of external nature, to give in my generation an impulsion to the progress of ethical and physical science, and, therefore, I ought not, on this occasion, to omit stating the result of an experiment conducted *on the same principle*, although I had an opportunity of making it under the waters of the deep, as in the case of the one which I have just described.

With the assistance of my friend Mr.

Goddard, the lecturer in optics at the Adelaide Gallery of Practical Science, and using the oxyhydrogen gas-light, that ethereal effluence of the spirit of terrestrial fire, the great parabolical reflector, and the magnificent double convex lens belonging to that establishment, I rendered distinctly legible, while placed in water which I had artificially darkened, the black-lead pencil-writing which I send you with the *Morning Chronicle* at the greatest distance from the ignited line in the focus which was possible to be attained in a right line from the table of the lecture room, viz., from that table on which was placed, on its stand, the refulgent parabolic reflector, through the door of the lecture-room into the ante-room, and then almost to the opposite end of the latter apartment; I say " almost," as a glass case occupies the extremity of the ante-room.

I should be exceedingly deficient in good taste and good feeling were I to conclude this letter without expressing my sense of deep and grateful obligation to Mr. Goddard and my other friends, Mr. Braddely, the director, and Mr. Maugham, the late lecturer in chemistry, who, not only, without solicitation on my part, placed at my disposal for experiment, whatever I might require, of any kind whatever, of what is contained in the resplendent collection of the gallery, but have frequently, even after the fatigues of the day, remained away from the comforts of their English firesides, that they might give me their personal aid and assistance in my humble efforts to promote the progression of submarine science—a department of human knowledge exceedingly picturesque and beautiful, and even now very useful—even now, although it be utterly in its infancy as a practical science.

It is very useful; and the first voyage which was made by one of the human species, who paddled himself on a float of bullrushes across a placid river, was also very useful as a first essay in navigation, although it were not, perhaps, quite equal to the midnight navigation of the *Great Western*, steaming through the wild billows of the Atlantic Ocean, amidst the howling and raving, and yelling of the tempest, the flashing of lurid lightnings, and the voice of the thunder in the firmament.

Even this which I have just described is nothing more than another stage of the infancy of the infancy of navigation!

The mariner's compass is called, with exquisitely felicitous beauty, in the native language of Ireland, by a name which signifies " *the intellectual power of the ship*"—its directing spirit. How many other *intellectual intelligences*, in addition to the *compass* and the *steam-engine*, and of far *more intense spiritualization*, may not accident and science evolve hereafter from the secret recesses of nature for the use of navigation? There is a Greek word in the " Prometheus" of Æschylus, which well describes the steam-engine under Watt's improvements, " *Σειδηροφρων*." It is almost a being with an iron mind, so intense is its power of self-regulation in its action.

I predict, in plenitude of internal confidence, that submarine science is destined to be in future ages of stupendous interest to mankind; that it will give a second " new world" added to the old.

The prodigies produced in this age by the magic of physical science are merely infinitesimal parts, are mere " embryon atoms" of the scientific miracles in the womb of nature, which are destined, if human nature retain its intellectual essence, inevitably destined to come into existence hereafter.

Let me, then, assume that this world shall endure, and that the human spirit—the spirit of beings of the same species which gave Newton and Watt to existence, shall roll on in its continually and inevitably accumulating tide of knowledge—the result of the effort of its " intelligential substance," and of accident—of

> " Circumstance, that unspiritual God,
> And miscreator."

Let me assume this, and will any man be found so presumptuous, so puffed up by the chivalry of self-conceit of his own judgment and capacity, or in such " ghastlie dreariment" of ignorance of the sublime energies and resources of the human spirit in mechanical, chemical, and physiological science, as flippantly to deny it to be possible that it may be in remote ages a matter of mere common-place and every day occurrence, for men to descend from the earth, and to live, and move, and have their being, even among awfully organised living creatures of the deep, far, far adown beneath the dismal, the horrific revelry of the foaming billows with the tornado, and to hold solemn communion with nature, and contemplation of nature's works, in the ever-flowing fountains, the mystic abysses of the ocean!

I have the honour to be, Sir,
With great respect,
Your most obedient humble servant,
THOMAS STEELE,
Inventor of the Communicating Diving Bell.

London, February, 1840.

CHAPMAN'S PATENT EXPANSION GEAR.

Mr. George Chapman, of Whitby, has lately patented a most ingenious expansion gear, which has been found to effect a most important saving in steam-engine working. It is, indeed, almost as important a step

erfection as the expansive use of
lf was found to be when first dis-
The action of this new expansion
unded upon a correct theory of cal-
beautifully carried out into a prac-
e. The gear is connected with the
so that the engine itself regulates
tion of the steam, according to the
be performed. The invention has
ired by patents in Great Britain,
n the principal continental states.
other testimonials which we have
e saving effected by its adoption,
following. The first is from Mr.
of the Beverly Iron Works, who
Mr. Chapman, that the "practical
your patent expansion gear, more
izes my expectation, for I feel cer-
ny engine is doing more than one-
e work, with one-third less quan-
l. The apparatus only wants to be
be generally adopted, more espe-
those parties who are in want of
hich was the case with me, for I
y do a part of my work, but with
your invention I can do the whole.'
. Grimston and Co., of the Clifford
therby state, that with the "Expan-
attached to their engine, on a fair
ree clear days, the saving of fuel
8 cwt. per day, which they con-
y well for an eight horse engine."
. Bainbridge and Son, of the Tees
ll, write as follows :—
have had Mr. Chapman's patent
gear in operation some months,
eam engine of 30 horse power, and
nitted it to various tests, and the
ave been, in the greatest degree,
prove it an appendage of inesti-
rth to a steam-engine.
have satisfactorily shown to our-
l engine-man, that there is a full
25 per cent. in fuel, to produce the
ntity of manufactured goods ; and
further proved that the engine will
25 per cent., or one-fourth more
y to a better purpose, with the
ar, than it will with our governors
lating the engine.
we have further satisfied ourselves
ms taken with the steam indicator
r own inspection, and afterwards
g the same), that the engine works
ctually and powerfully with the
pansion gear, all these experiments
ow the same results, and prove the
efit derived from the application of
ion."
pe shortly to be able to present our
ith a full description of this most
improvement upon the steam-

ACTION OF SEA WATER ON IRON.

[*From the Proceedings of the Inst. C.E.*]

The analysis of a piece of iron converted, by the action of sea water, into a substance resembling plumbago, was read by Mr. D. Mushet.–In this communication Mr. Mushet gives the result of his analysis of a piece of the iron heel-post of a vessel, called the *John Bull*, which, by the effect of salt water, was converted into a substance resembling plumbago. This substance was of a dark brown colour, and easily cut by a knife ; on being exposed to a red heat, in a crucible, it lost about 20 per cent. in weight, and on being exposed to a white heat for four hours, it lost about 60 per cent., and came out a light mass of very brilliant carburet. This shining carburet was then used as a carbonaceous substance for the reduction of an oxide of iron, but was less efficacious than the same quantity of the charcoal of wood. From these and other experiments, Mr. Mushet considers 100 parts to be composed as follows :—

Carbonic Acid and Moisture ..	20
Protoxyde of Iron	35.7
Silt, or earthy matter	7.2
Carbon	41.1

ON THE EXPANSION OF ARCHES. BY G. RENNIE, ESQ.

The expansion of solids, which has excited the attention of mathematicians since the investigations of La Hire, in 1688, on a rod of iron, is of particular importance in the construction of bridges, the security of which may be affected by the dilatation and contraction consequent on changes of temperature. Periodical motions, referable only to changes of temperature, were observed by Vicat, in a stone bridge, built over the Dordogne, at Souillac, and have frequently been noticed in structures of all kinds. The different expansibilities of stone and iron have been considered an objection to the use of cast iron pillars in connection with stone, to support the fronts of buildings ; but the experiments of Mr. Adie, of Edinburgh, led him to the conclusion that no danger is to be apprehended from a change of temperature affecting cast iron and sandstone in any great degree, as their expansion, so far as regards buildings, may be considered the same. Arguments from this source were employed against the arches of Southwark-bridge, and the experiments set forth in this communication were undertaken with a view of ascertaining the effect of temperature on these arches. Three sets of experiments were made, the first in January, 1818, when the main ribs and diagonal braces rested on their centres, and before any of the spandrils and road plates had been

put upon them ; the second in August and September of the same year. The rise was measured by the insertion of small wedges, by which the rise was ascertained to about $\frac{1}{40}$th of an inch. The most extensive set of experiments were made on the eastern arch. Great care was taken in observing the thermometers, of which there were three, one in the open air, another among the ribs, and the third inserted in the iron of the rib. The result of nine experiments gave as a mean, a rise of $\frac{1}{40}$ of an inch for 1° Fah. The effects of changes of temperature were also observed in the stone bridge over the Thames, at Staines. After the arches had obtained their full settlement, openings were observed in the joints of the parapets immediately over the springing of the arches, and a distortion, or sinking, of the upper curve of the parapets. A wedge was inserted into some of these openings, and the lowest point of its descent, in the month of January, marked, The same wedges were carefully inserted every week until May, when they would no longer enter, and the joints became firmly closed. At this period, however, the joints immediately over the crowns of the arches, which had, during the winter, been quite close, were open. From these facts it followed, as a necessary consequence, that in winter the arch contracting descends, and the spandril joints opened, and in summer the arch expanding rose, and closed these joints, and opened those at the crowns. Thus the joints of the parapets, which were made of single slabs of granite for the whole height, became good indicators of the change of temperature. It had also been observed in the Waterloo and other bridges, that, joints made good in the winter with Roman cement, were found crushed in summer. The details of these experiments, and of others, on the expansion of a large portion of the frieze plates, and the calculations to which they give rise, occupy the principal portion of this communication.

LIST OF DESIGNS REGISTERED BETWEEN JANUARY 29, AND FEBRUARY 27, 1840.

Date of Registration. 1840.	Number on the Register.	Registered Proprietor's Name.	Subject of Design.	Time for which the protection is granted.
Jan. 29.	242	Thos. Nicholson and H. E. Hoole	Fender	3 years
29.	243	R. Harris	Glasses	1
29.	244	J. Rodgers and Sons	Braces	3
29.	245	Ditto	Belt	3
Feb. 3.	246	Ditto	Purse	1
4.	247	W. Thornthwaite	Ruler	3
5.	248	T. Staight	Thermometer	3
"	249	R. Harris	Tumbler	1
11.	250	H. Tuck	Postage weight mark	1
12.	251	T. Eddington and Sons	Vase	3
13.	252, 3	C. T. Cooke	Cylinders	3
"	254, 5	H. N. Turner and Co.	Stained paper	1
"	256	C. Griffin	Letter-balance	3
14.	257	J. Dobson and Sons	Pattern for Carpet-bag	1
17.	258	W. J. Curtis	Spiral spike or nail	3
"	259	J. Gold	Chandelier drops	1
18.	260	T. Charles	Coal-cellar iron plate	3
"	261	T. Lambert and Son	Weighted ball valve	3
"	262	H. Knight	Seal stamp	3
19.	263	S. Downer	Alarum letter-box	3
21.	264, 5	J. Gold	Pattern for glasses	1
27.	266	H. Longden and Sons	Stove	3

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 28TH OF JANUARY AND THE 27TH OF FEBRUARY, 1840.

Moses Poole, of Lincoln's-inn, gentleman, for improvements in pumps for raising and forcing water and other fluids. (A communication.) Jan. *30; six months to specify.*

William Brockedon, of Queen-square, Middlesex, esq., for improvements in the means of retaining fluids in bottles, decanters, and other vessels. Jan. 31; six months.

Philippe Marie Moindron, of Bedford-place, Russell-square, merchant, for improvements in the construction of furnaces and in boilers. (A communication.) Jan. 31; six months.

William Cubitt, of Gray's-inn-road, builder, for an improvement or improvements in roofing. Jan. 31; six months.

Crott on William Most,I Thistle-grove, Bromp -

ton, esq., for a new and improved method of applying steam power to carriages on ordinary roads. Feb. 5; six months.

Wilkinson Steele and Patrick Sanderson Steele, manufacturing ironmongers, of George-street, Edinburgh, for improvements in kitchen ranges for culinary purposes, and apparatus for raising the temperature of water for baths and other uses. Feb. 5; six months.

William Isaac Cookson, of Newcastle-upon-Tyne, esq., for certain improved processes or operations for obtaining copper and other metals from metallic ores. Feb. 5; six months.

Thomas Myerscough, of Little Bolton, manager, and William Sykes, of Manchester, machine maker, for certain improvements in the construction of looms for weaving or producing a new or improved manufacture of fabrics, and also in the arrangement of machinery to produce other descriptions of woven goods or fabrics. Feb. 5; six months.

Samuel Carson, of Caroline-street, Coleshill, Eaton-square, Middlesex, gentleman, for improvements in apparatus for withdrawing air or vapours. Feb. 5; six months.

Joseph Needham Taylor, of Plymouth, captain in the Royal Navy, for improvements in steamboats and vessels making applicable the power of the steam engine to new and useful purposes of navigation. Feb. 8; six months.

John Werthemier, of West-street, Finsbury-circus, printer, for certain improvements in preserving animal and vegetable substances and liquids. (A communication.) Feb. 8; six months.

Robert Beart, of Godmanchester, miller, for improvements in apparatus for filtering fluids. Feb. 8; six months.

Amand Deplanque, of Leicester-square, gentleman, for improvements in looms for weaving. (A communication.) Feb. 8; six months.

Edmund Rudge, jun., of Tewkesbury, tanner, for a new method or methods of obtaining power for locomotive and other purposes and of applying the same. Feb. 8; six months.

James Hancock, of Gloucester-place, Walworth, for a method of forming a fabric or fabrics applicable to various uses, by combining caoutchouc or certain compounds thereof with wood, whalebone, or other fibrous materials, vegetable or animal, manufactured or prepared for that purpose, or with metallic substances manufactured or prepared. Feb. 8; six months.

George Eugene Magnus, of Manchester, merchant, for certain improvements in manufacturing, polishing and finishing slate, and in the application of the same to domestic and other useful purposes. Feb. 8; six months.

Robert Willis, of the University of Cambridge, clerk, for improvements in apparatus for weighing. Feb. 12; six months.

David Napier, of York-road, Lambeth, engineer, for improvements in the manufacture of projectiles. Feb. 12; six months.

Antoine Blanc, of Paris, merchant, and Theophile Gervais Bazille, of Rouen, merchant, for certain improvements in the manufacturing or producing soda, and other articles obtained by or from the decomposition of common salt or chloride of sodium. Feb. 12; six months.

Thomas Robinson Williams, of Cheapside, gentleman, for certain improvements in the manufacture of woollen and other fabric or fabrics of which wool or fur form a principal component part, and in the machinery employed for effecting that object. Feb. 14; six months.

Joseph Clarke, of Boston, printer, for improvements in piano fortes. Feb. 14; six months.

Gerard Ralston, of Tokenhouse-yard, merchant, for improvements in rolling puddle balls or other masses of iron. (A communication.) Feb. 22; six months.

Richard Cuerton, jun., of Percy-street, Middlesex, brass founder, *for improvements* in the manu*facture of cornishes, mouldings,* and window sashes. *(A communication.) Feb. 22;* six months.

William Cook, of King-street, Regent-street, coachmaker, for improvements in carriages. Feb. 22; six months.

Thomas Kerr, of Forecrofts Dunse, in the county of Berwick, esq., for a new and improved mortar or cement for building, also for mouldings, castings, statuary, tiles, pottery, imitations of soft and hard rocks, and other useful purposes, and which mortar or cement is applicable as a manure for promoting vegetation and destroying noxious insects. Feb. 22; six months.

John Hanson, of Huddersfield, engineer, for certain improvements in meters for measuring volumes of gas, water and other fluids, when passed through them, and, in the construction of cocks or valves applicable to such purposes. Feb. 22; six months.

William Winsor, of Rathbone-place, artists' colourman, for a certain method or certain methods of preserving and using colours. Feb. 22; six months.

Job Cutler, of Lady Pool-lane, Birmingham, gent., and Thomas Gregory Hancock, of Highgate, Birmingham. aforesaid, mechanist, for an improved method of cutting corks and constructing the necks of bottles. Feb. 22; six months.

William Brindley, of Northwood-street, Birmingham, for improvements in apparatus employed in pressing cotton wool and goods of various descriptions. Feb. 25; six months.

Thomas Huckrale, of Over Norton, Oxford, farmer, for improvements in ploughs. Feb. 25; six months.

Thomas Farmer, of Gunnersbury House, near Acton, Middlesex, Esq., for improvements in treating pyrites to obtain sulphur, sulphureous acid, and other products, Feb. 25; six months.

John Wilson, of Liverpool, lecturer on chemistry, for an improvement or improvements in the process or processes of manufacturing the carbonate of soda. Feb. 25; six months.

Richard Kingdon, of Gothic House, Stockwell, surgeon, for certain improvements in apparatus for the support of the human body, and the correction of curvatures and other distortions of the spine of the human body. Feb. 25; six months.

Thomas Milner, of Liverpool, safety-box manufacturer, for certain improvements in boxes, safes, or other depositories, for the protection of papers, or other materials, from fire. Feb. 26: six months.

William Morritt Williams, of Bedford-place, Commercial-road, professor of mathematics, for an improved lock and key. Feb. 27; six months.

Rowland Macdonald Stephenson, of Upper Thames-street, in the city of London, civil engineer, for certain improvements in shifting and working stage scenes, and other theatrical machinery. Feb. 28; six months.

LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 22nd OF JANUARY AND 22nd OF FEBRUARY, 1840.

Robert Lorimer, brass founder, No. 45, Jamaica-street, Glasgow, North Britain, an improvement or improvements on stoves. Sealed Jan. 25, 1840; four months to specify.

Miles Berry, of Chancery-lane, Middlesex, (communication from a foreigner), an invention or discovery by which certain textile or fibrous plants are rendered applicable to making paper, and spinning into yarns, and weaving into cloth, in place of flax, hemp, cotton, and other fibrous materials commonly used for such purposes. Jan. 27.

John Jones, of Westfield-place, Sheffield, York, a new frying and grilling pan for the cooking of steaks, chops, and other meats. Jan. 29.

Robert Hervey, of Manchester, Lancaster, drysalter, certain improvements in the mode of preparing and purifying alum, alumina, aluminous

mordants, and other aluminous combinations and solutions, and the application of such improvements to the purposes of manufacture. Jan. 31.

Francis Worrell Stevens, of Chigwell, Essex, school master, certain improvements in apparatus for propelling boats and other vessels on water. Feb. 1.

William Isaac Cookson, of Newcastle-upon-Tyne, esquire, certain improved processes or operations for obtaining copper and other metals from metallic ores. Feb. 3.

George Wilson, of St. Martin's-court, St. Martin's-lane, Middlesex, stationer, an improved paper cutting machine. Feb. 3.

Miles Berry, of Chancery-lane, Middlesex (communication from a foreigner), certain improvements in machinery or apparatus for making or manufacturing pins, and sticking them in paper. Feb. 5.

Godfrey Anthony Ermen, of Manchester, Lancaster, cotton spinner, certain improvements in machinery or apparatus for spinning, doubling, or twisting cotton, flax, wool, or other fibrous materials, part of which improvements are applicable to machinery in general. Feb. 5.

James Capple Miller, of Manchester, Lancaster, gentleman, certain improvements in printing calicoes, muslins, and other fabrics. Feb. 7.

John Alexander Philip de Val Marino, of No. 17, Clifford-street, Bond-street, Middlesex, esquire, certain improvements in the manufacture of gas, and in the apparatus employed for consuming gas for the purposes of producing light. Feb. 7.

John Francis Victor Fabien, of King-street, London, gentleman, (communication from a foreigner), improvements in pumps. Feb. 12.

Jonathan Fell, of Workington, Cumberland, ship builder, improvements in building ships and other vessels. Feb. 12.

John Reynolds, of Victoria Hotel, Euston-square, Middlesex, Esq., improvements in the manufacture of salt. Feb. 12.

Henry Pinkus, late of Pennsylvania, in the United States of America, but now of 79, Oxford-street, Middlesex, gentleman, improvements in inland transit, some of which improvements are applicable to, and may be combined with, an improved method of, or apparatus for, communicating and transmitting, or extending, motive power, by means whereof carriages or waggons may be propelled on railways or roads, and vessels may be propelled on canals. Feb. 19.

LIST OF IRISH PATENTS GRANTED IN JANUARY, 1840.

Miles Berry, for an invention or discovery by which certain textile or fibrous plants are rendered applicable to making paper and spinning into yarns and weaving into cloth in place of flax, hemp, cotton, and other fibrous materials commonly used for such purposes.

Edward Dampier, for an improved weighing machine.

George Chapman, for certain improvements in steam engines. Jan. 22.

NOTES AND NOTICES.

Wooden Pavement in Russia. — (Extract from Leitch Ritchie's "Glance at Russia in 1835.)—The wooden pavement is, I believe, peculiar to St. Petersburg, and merits a description. It consists of small hexagons sawed from a piece of resinous wood, and laid into a bed of crushed stones and sand. These are fastened laterally into each other with wooden pegs; and when the whole forms a plane surface, the interstices are filled with fine sand, and then boiling pitch is poured over all. This pitch, from the porous nature of the wood, is speedily absorbed; and on a quantity of sand being strewed above it, the operation is complete, and a pavement constructed which is found to be extremely durable, and which seems to me to suffer much less injury from the frost than the stone causeway. The honour of the invention is due to Mr. Gourief, and I have no doubt he will ultimately see it adopted in most of the great towns towards the north. It is the custom of the peasantry to cut down the trees at some distance from the root, and thus a great deal of wood will be turned to a useful purpose, which would otherwise only encumber the ground. Every peasant, besides, by means of his axe alone, is able to construct such a pavement; and in Russia, hands are both plenty and cheap.

Use of Varnish of Dextrine or Starch in the Fine Arts.—In the sitting of the Academy of Sciences, Monday, 26th August, Baron De Silvestre made the following remarks on the occasion of M. Arago's communication on the preservation of photographic images. He observed that it would be interesting to try dextrine for this purpose, as he himself, for more than two years, ad successfully used this substance for varnishing pictures newly painted in oil, water colour drawing, coloured lithographs, and for the permanent fixation of pencil drawings. He had also obtained from dextrine a glue, which he found superseded with advantage all other gluey substances, and particularly mouth glue. In these different applications dextrine is mixed with water in different proportions; two parts to six of water for varnish, and in equal parts for glue. He observed that he always added one part of alcohol in the composition of the varnish, and half a part in that of the glue. The mixture should be always filtered before being used for varnishing pictures and fixing drawings, and in this latter case, a fine wet muslin should be spread over the drawing, before covering it with the mixture of filtered dextrine. The description of these processes, and of the results obtained, is given in the *Bulletin de la Societe d'Encouragement pour l'Industrie Nationale*, for the 2d of August, 1837.

Compression of Gas.—In a memoir on the compression of gases, and on the reduction of variable pressures, into regular pressure, M. Seguin gives the Academy of Sciences a description of a new pump, with a regulating apparatus, for the compression of gas for illumination obtained from the distillation of animal substances. The pump is so arranged as to give the maximum force at the moment of the course when the gas presents the maximum of resistance by the diminution of its volume; to work in a vertical position without loss of gas, and without the piston being immersed in fluid; and lastly to avoid, by means of a particular mode of transmitting power, the use of guides, which would cause a friction in the piston rod.

Saw Setting Instrument.—A correspondent who signs himself "ϕ." states that for more than two years he has seen an instrument precisely the same as that figured and described in our 862d number, and communicated by Mr. Morehen, builder, of Cambridge, as of his invention, exposed for sale at the different fairs of Norfolk and Suffolk, by itinerant vendors of tools. The instrument is not in general use amongst carpenters, and if Mr. Morehen be not truly the inventor, he might have contented himself with the merit of being the means of its publication, and not have *appropriated* that of its invention. If he was the author of the invention previous to the date abovementioned, and others *appropriated* it to his disadvantage, we shall be happy if he will enable us to set the matter right with our readers.

LONDON: Printed and Published for the Proprietor, by W. A. Robertson, at the Mechanics' Magazine *Office, No. 166, Fleet-street.*—Sold by A. & W. Galignani, Rue Vivienne, Paris.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

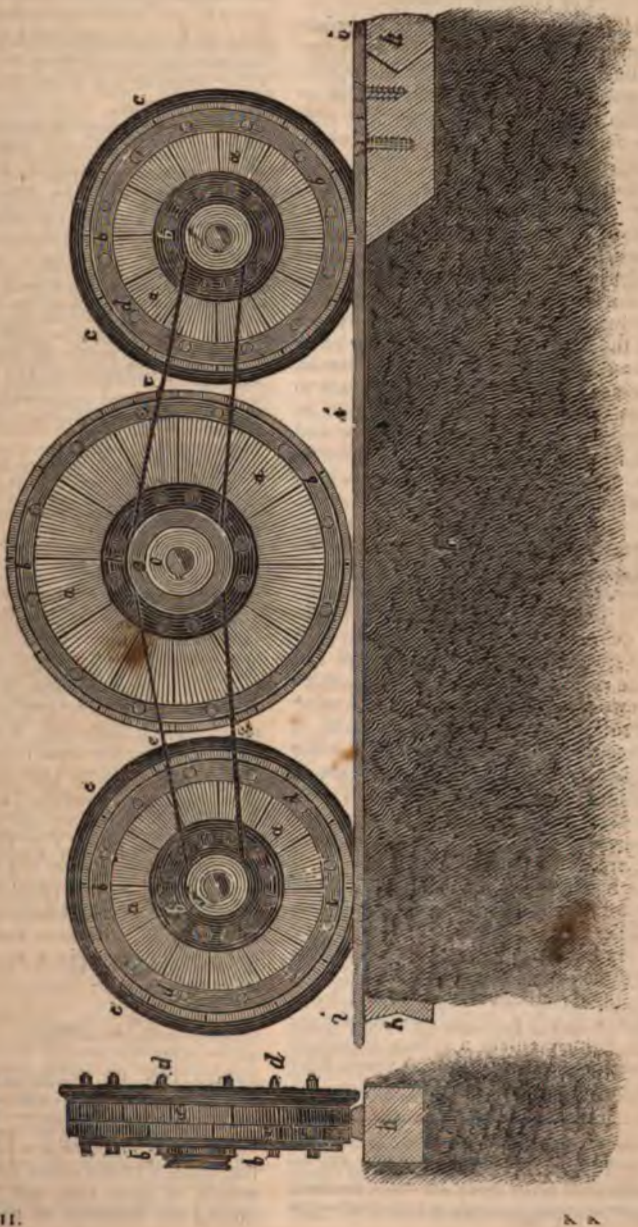
No. 865.] SATURDAY, MARCH 7, 1840. [Price 3*d*.

Printed and Published for the Proprietor, by W. A. Robertson, No. 166, Fleet-street.

PARKIN'S PATENT CONCRETE RAILWAY, AND SAFETY RAILWAY WHEEL.

Fig. 1.

Fig. 2.



PARKIN'S PATENT CONCRETE RAILWAY, AND SAFETY RAILWAY WHEEL, COMBINED OF WOOD AND IRON.*

[Communicated by the Inventor.]

The Concrete Railway.

It is now admitted by all scientific men of eminence that for rails longitudinal, continuous, wooden bearers are much preferable to either stone or wooden isolated sleepers; and that concrete forms the best foundation, while, in respect to economy, the above combination admits of no comparison with other modes of construction.

Nearly *three years* ago Mr. Parkin laid down some rails at Llanelly on continuous wooden bearers and a concrete foundation, and the railway, though in constant use, continues as perfect as when made, having, with the exception of a few screws being replaced, required no repairs whatever, while none will be required for years to come; the statement of which fact, as railway proprietors in general now find their returns not to be commensurate with their outlay, will, doubtless have its effect.

The Safety Railway Wheel.

The wheels and axles of railway carriages often break from the severity of the concussions produced by high speed; and it is of vast importance to lessen this danger. Mr. Parkin's wheels will effect this object, as the wood will run on the rails, and the effect be the same as on wood pavement, the immense value whereof the public have the means of appreciating. In the ratio that noise and jolting cease, security and ease in travelling increase, and wear and tear decrease; while the first cost of the wheels, and that of keeping them in repair, are much lessened.

Each wheel is made with 24 sectors of wood *a*, with the grain extending from the axle in the direction of the radius, and are held firmly together at the centre by two cast iron wheels *b*, and 12 bolts and nuts *d*; and at the periphery, by a cast iron flanch *c*, drilled, about 5 inches deep, (which enters a rebate turned in the sectors, and is further supported by 12 arms, or spokes, fitted in between the outer circumference of the cheek and the inner circumference of the flanch), a corresponding wrought iron ring, and an equal number of bolts and nuts. The sectors are well boiled, and the joints crossed, to insure rotundity. The sectors and flanch will wear a long while, but can be replaced when requisite, every other part of the wheel being of indefinite durability.

Besides a transverse view of the wheel, the drawing represents three wheels for a locomotive engine, a band passing from the nave of the driving wheel to the nave of each of the other wheels, in order to relieve the driving wheel of part of the stress thrown on it in giving motion to the train, according to the plan about to be adopted on the Sheffield and Rotherham Railway. As the driving wheel may be made of any convenient width, the necessity of the flanch is dispensed with, and such wheel can consequently be made for less than half its present cost.

Before this will appear in print, some of the wheels will doubtless be in use on the Eastern Counties Railway.

THOS. PARKIN.

25, Moorgate-street, City.

Description of Engravings.—Fig. 1, a side view of three railway carriage wheels connected as above described. Fig. 2, an edge view of one of the wheels. Both these figures show the wheels upon the improved concrete railway—which is partly shown in section. *a a*, the wooden sectors; *b b*, the iron rings joining the sectors; *d d*, bolts and nuts securing the rings and sectors; *c c*, cast iron flange; *e e*, rope or band connecting the three wheels; *f f*, the pullies on the naves of the fore and hind wheels; *g*, the pulley on the nave of the driving wheel. *h h h*, the longitudinal wooden sleepers; *i i*, the sails fastened thereto by pins or screws; *k k*, the concrete foundation.

INVENTION OF MERCURIAL LETTER AND MONEY BALANCES—BURSILL'S IMPROVED BALANCE.

Sir,—Some years ago I had a mercurial balance constructed for testing the weight of gold coin, and by greatly reducing the diameter of the piston, the

* The plans described in this article (with the exception of the connection of the three wheels,) form part of the same patent as includes the dimensions described in our 852nd and 858th numbers; the patent is dated April 9th, and the specification enrolled Oct. 9th, 1839.

instrument was rendered so delicately sensitive that I was enabled to substitute it with advantage for a pair of assay scales, it being made to indicate most distinctly even the fractional part of a grain.*

I must candidly acknowledge that it is only recently I applied the same principle of construction to a letter balance, one of the latter I had made for me by Messrs. Tagliabue and Casella, of 23, Hatton Garden, whom I had put in possession of my designs; after which a notice was pointed out to me in your scientific work, showing that the priority of the invention was already in dispute between a Mr. Miller, of Dundee, and a Mr. Osler, of Birmingham.

The principal difference between the mercurial balance described in your Magazine, and my registered letter balances, as manufactured by Messrs. Tagliabue and Casella is, that I employ a *moveable* instead of a fixed scale; so that the operation is enabled to start fair, notwithstanding any rise or fall of the piston that may have been induced by a change of temperature acting upon the mercury. The instrument also is portable, without any danger of spilling the mercury; and is adapted to the weighing of gold coin, &c.

In others, I make use not of a cylindrical, but of a half round piston (as being more sensitive,) the flat side of which preventsit from turning round, while the result is registered by a little *moveable* indicator placed above the mercury. My brother, however, has adapted the instrument to weighing machines in general in a manner which will, I think, receive your unqualified approbation, which he will be happy to communicate as soon as it is secured to him.

Owing to the publicity that has already been given to the principle upon which instruments of this kind generally are constructed, I shall feel greatly obliged by your notice of these facts, having no doubt that I shall be enabled to afford the most ample proof when called upon of my being the first inventor of the mercurial balance.

Mr. G. McLeod, of Stoke Newington has suggested to me, that in order to save trouble to the numerous postmasters, when the new stamps shall come into operation, it would be desirable to have a machine placed behind the opening of their respective letter boxes, and so constructed as to at once weigh and deliver the letters into separate chambers agreeably to the prices charged for posting; should any of your ingenious correspondents devise a practical and expeditious method of effecting this object, I should say they would find their advantage in bringing it into operation.

In conclusion, may I be allowed to thank you for your unsolicited attention in one of your former numbers to an invention for which my brother and self received a reward from the Society of Arts; I allude to your notice of "A. Bursill's condensed air lamp and breathing apparatus for miners."

I am, Sir,
Your obedient servant,
G. H. BURSILL.

3, River Lane, Lower Road Islington,
Feb. 2[illegible] 1840.

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* The subjoined is a letter in verification of this statement from the person who made the balance referred to.

Sir,—About six years ago I made a mercurial balance for Mr. G. Bursill, to be used for trying the weight of sovereigns, &c.; my recollection of the circumstance is very distinct, as the tube I employed in the first instance was a piece cut off an old gun barrel, plugged up at the bottom with soft iron bought at Redmund's foundry.

I have always heard say that the action was perfect.

I remain, Sir, your obedient servant,
PETER SCOTT.

15, Wellington-street, Pentonville, Feb. 27, 1840.

SIR J. E. ALEXANDER ON A MECHANICAL MEANS FOR DEVELOPING THE POWERS OF THE VOICE.

Mr. Editor,—As it is the duty of every one to communicate whatever may be of advantage to the community, as an old subscriber to your valuable periodical, I beg to state that lately great benefit has been derived by some children with defective utterance, by being made to read slowly and distinctly for half an hour, or more, each day, and keeping at the same time between the front teeth *a thin slip of wood*, so as to open the mouth from three-fourths of an inch to one inch.

Demosthenes, the orator, we read, cured his defective utterance by stones in the mouth, doubtless for no other purpose than to keep it open in speaking—this semi-gagging system then with

wood, may possibly have been the Demosthenean method with stones.

The Italians sing better than the English, because they habitually open the mouth in pronouncing the *ā*. The use of an upright piece of wood, then, between the front teeth to accustom one to open his mouth prevents exhaustion in oratory and enables one to pronounce "*ore rotundo.*"

I am, &c.

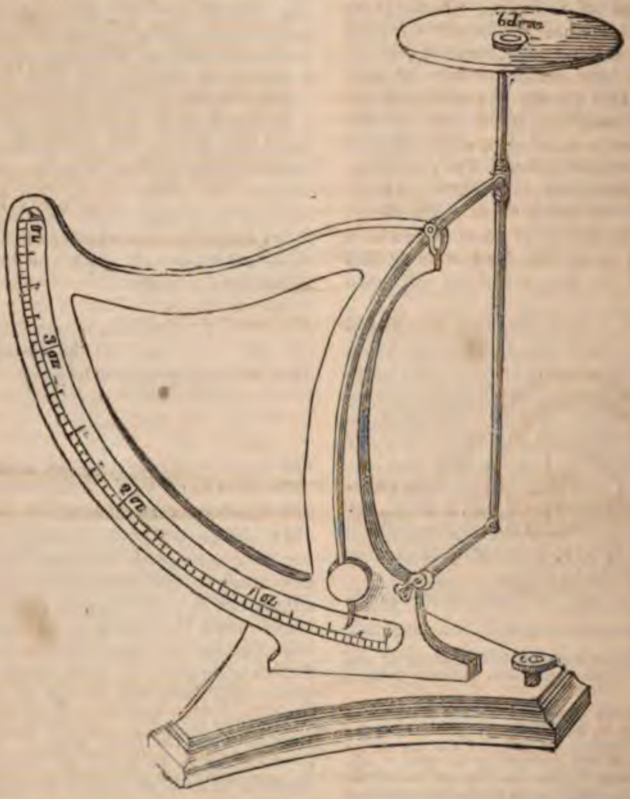
JAS. EDW. ALEXANDER.

United Service Club, March 3, 1840.

QUADRANT LETTER-BALANCE.

SIR,—The vast advantages accruing from the introduction of the "universal penny post," suffices to render any trifle which facilitates its use, of general interest. One important assistant to the complete enjoyment of this method of communication, is a ready means of weighing not only letters, but any other little matter proposed to be inclosed therein.

At a distance from any of the grand emporiums where wants of this kind are



no sooner felt than supplied, I was pleased to find in your *Magazine* a description of "Riddle's Letter-balance," *which I immediately* ordered, through my stationer. As this has, however, not come to hand, necessity has induced me to construct something for my own use; and as it appears to me to possess

some advantage over others that I have seen, I take the liberty of forwarding a sketch of it, for insertion in your *Magazine*, if you think well.

I agree with the ingenious Mr. Riddle, that the old and well known principle of the bent lever balance is well adapted for a letter-balance, if made in the old-fashioned way, with the scale at the extremity or greatest radius of the levers, by which means the divisions are of course larger than in any other arrangement. In my balance, which weighs up to four ounces, the ounce is divided into 16ths or drams, which measure in the first half-ounce near one-eighth of an inch each, and much more in the second and third ounces.

Instead of a hook, which is only adapted for small letters when folded, I use a flat scale-board, made of thin ivory, with a simple parallel motion to keep it level. This renders the apparatus available for weighing small articles, which could not be at all suspended on a wire hook; besides plans, open papers, or rolls of plans, &c., previous to folding.

There is another little addition necessary to the accuracy of any weighing-machine upon the bent lever principle, namely, some means of bringing the *index to zero* before using, *without any thing* in the scale, which will not be the case if the instrument stand at all *out of level.*

My balance *stands upon three points alone*, one of which is the rounded end of an adjusting screw, by turning which, if necessary, the index is brought to zero of the scale, with the greatest nicety.

The foot and frame of my machine is made of mahogany, radius of quadrant 7 inches, total height 10½ inches, the gradiator quadrant of ivory, the divisions being obtained by absolute weight put in the scale-board, the lever, spindle, and parallel motion of iron.

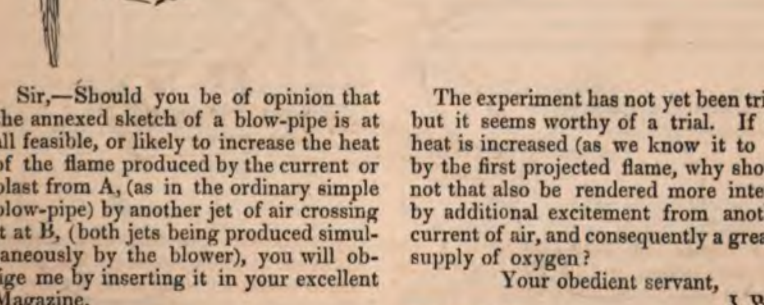
For post-offices and places of large business, I can scarcely imagine any apparatus which would afford greater facilities in use; *expedition*, from the facility of placing any formed article on the scale, followed by the immediate result shown by the index, and *accuracy* from the *magnitude* of the divisions.

I am, Sir, your obedient servant,

George Edwards.

Lowestoft Harbour, Jan. 30, 1840.

DOUBLE BLAST BLOW-PIPE.



Sir,—Should you be of opinion that the annexed sketch of a blow-pipe is at all feasible, or likely to increase the heat of the flame produced by the current or blast from A, (as in the ordinary simple blow-pipe) by another jet of air crossing it at B, (both jets being produced simultaneously by the blower), you will oblige me by inserting it in your excellent Magazine.

The experiment has not yet been tried, but it seems worthy of a trial. If the heat is increased (as we know it to be) by the first projected flame, why should not that also be rendered more intense by additional excitement from another current of air, and consequently a greater supply of oxygen?

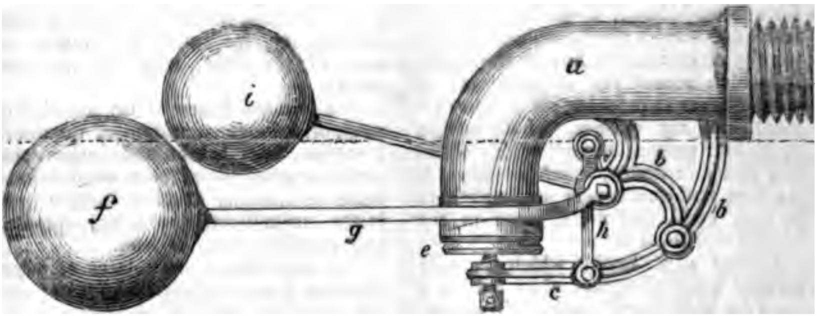
Your obedient servant,

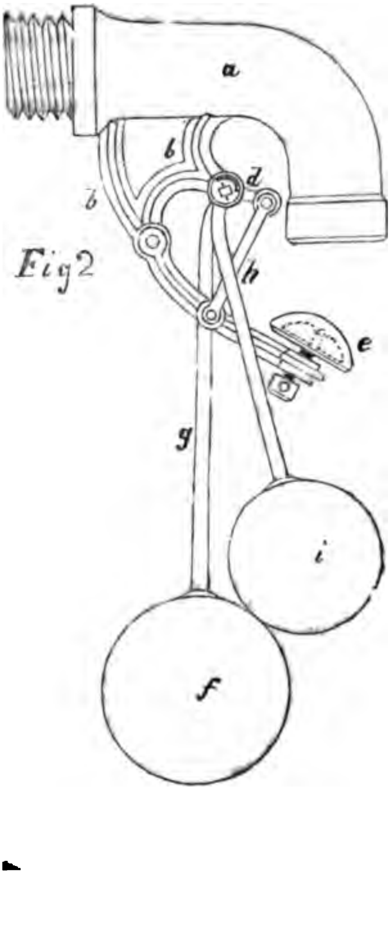
J. B.

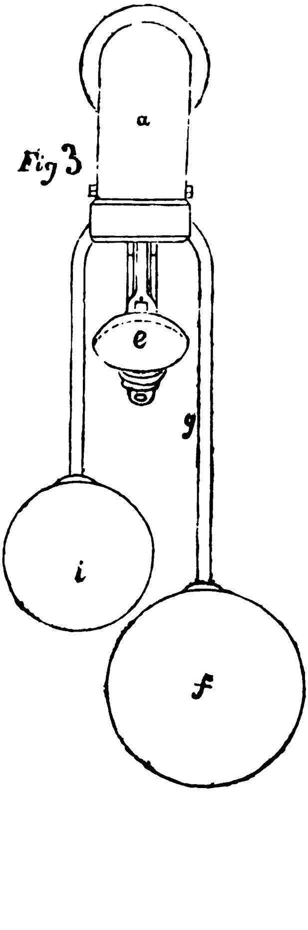
Feb. 22, 1840.

IMPROVED BALL COCK.

Fig. 1.







IMPROVED BALL COCK.

r,—I now furnish you with the ring of the ball cock as promised in ast communication. Fig. 1, is one view, in which the valve *e* is shown ; fig. 2 is the other side view with valve open, and fig. 3 is a front view ne same. The letters of reference he same in all the figures. The bent *a* has the parts *b b* cast on it, which as a fulcrum to the arm *c* and the k *d*. To the arm *c* is attached a rical valve *e*, which is ground into orifice of the tube *a* perfectly water-t. This valve is retained by the ball ough its arm *g*, acting on the crank *d*, which is attached the link *h*, con-ing the arm *c*. When the valve is as in fig 1, the position of the crank ich that the ball *f* has nearly the test power that it possibly can have; hat the valve will be able to resist pressure that a cock is likely to be ect to. When the valve is open, as in 2, the ball *f* hangs a little beyond the endicular line, so that when the r rises to the ball, it remains in that tion until carried over the centre by cond ball *i*; this ball works on a round of the same axis as the ball *f*, so that ats up as the water rises, until a pin ecting from its arm comes in contact the end of a notch cut out of a thin of metal fixed on the square end of crank axis, thereby carrying the ball er the perpendicular when it will be ed up by the water, closing the valve once. The ball *i* floats till the sur-of the water is again lowered. If cock should be used with one ball , it will run the full bore longer than other that I have seen. As all friction pening and shutting the valve is ded, there is little probability of its ing out of order; but should it leak ny time, by disengaging the valve *e* 1 the arm *c*, and grinding it on its for a few minutes with fine emery, ill be as perfect as ever.

I am, Sir, yours, &c.

J.+J.

odneston, Jan. 21, 1840.

CORRESPONDENCE RESPECTING THE ALLEGED PIRACIES OF MR. HUTCHISON.

It will be in the recollection of our readers that a communication was published in No. 859 of the *Mech. Mag.*, 25th January last, from the Rev. Mr. Bacon, complaining of the conduct of the party above mentioned, and also of a series of letters signed "Clovis," which he affirmed to have originated with the London Gas Company. In reference to Mr. Bacon's statement, we last week received the subjoined letter from the Solicitors of the Directors of that Company, which we insert by their request.

No. 1.—*Letter from Messrs. Foss and Clark, the Solicitors of the Directors of the London Gas Company, to the Publisher of the Mechanics' Magazine.*

"36, Essex-street, 28th February.

"Sir,—As you have thought fit to publish in No. 859 of the *Mechanics' Magazine* a libel upon those gentlemen who are Directors of the London Gas Light Company, and who were defendants in the proceedings in equity therein mentioned, imputing to them that they had anonymously published wilfully false representations, we, by their desire, request to know whether you will give up the manuscript and the author's name, or whether the gentlemen so libelled are to consider you solely responsible for the publication.

"In case you should give up the author, we further require you to publish this letter in the next number of the Magazine, in order that it may be known at once that the Directors of the London Gas Light Company wholly deny the charges made against them; and we are desired to add that though they do not think proper to enter into any controversy on the validity or invalidity of Mr. Bacon's patent (that question being shortly about to be decided in the Court of Common Pleas, when the true state of the case will be fully brought forward) yet they will proceed as advised by Counsel, in regard to the offensive personal imputations to which we have alluded.

"We are, Sir,
"Your obedient servants,
"Foss and Clark.

"Mr. W. A. Robertson,
"166, Fleet-street."

No. 2.—*The Publisher of the Mechanics' Magazine to Messrs. Foss and Clark.*

"166, Fleet-street, 29th January, 1840.

Gentlemen,—I have to acknowledge the receipt of your favour of yesterday's date, requesting to know whether I will give up the manuscript of an article which appeared

in No. 859 of the *Mechanics' Magazine*, which is supposed to affect "those gentlemen who are Directors of the London Gas Light Company," and also the "author's name," and I have in answer to state that I cannot give up the manuscript, as the printer is bound by law to retain it in his possession; but that the author of the paper is the Rev. Hugh Ford Bacon, whose name is subscribed to it, and who in delivering it into the Editor's hands for publication, stated that he was prepared, and held himself bound, to substantiate every allegation contained in it.

"Your letter did not reach me yesterday till after the number of the Magazine for this week was in print, and your request to have it published in it could not therefore be complied with; but it shall be inserted without fail next week.

"I am, Sir,
"Your obedient servant,
(Signed) "W. A. ROBERTSON.
"Messrs. Foss and Clark,
"36, Essex-street."

[Having forwarded a copy of Messrs. Foss and Clark's letter to Mr. Bacon, we have received from him the reply No. 3.]

No. 3.—*Rev. Mr. Bacon to the Editor of the Mechanics' Magazine.*

"Sir,—I have received the copy of a letter from Messrs. Foss and Clark, which you have been kind enough to forward to me. I am pledged, of course, to protect you from any proceedings to which you might be exposed by what you deemed an act of justice to me; but, on referring to my communication you will find, that the assertion that I have imputed the false representations signed 'Clovis,' personally, and especially to the Directors of the London Gas Company, is not justified by any expression it contains. What I have stated (and by that statement my letter is prefaced) is, that those representations emanated from the London Gas Company—that they are distinctly traceable to their Works; and, that though wilfully false in fact, they were published under a feigned signature, and then disavowed by the parties opposed to me in a hostile suit. For the proof of these statements I need only appeal to the documents in your possession, which you will be kind enough to publish, together with this letter.

"I am fully aware that every public company must act through its officers; for whose misconduct every member of the company is responsible. But the Directors, who are a fluctuating class of the proprietary, *are not the only* representatives with whose *acts the whole body* are justly chargeable. *A public company is*, if possible, even more deeply responsible for the proceedings of those officers to whose management their affairs are constantly entrusted, and whom they deliberately hold out to the public as the permanent representatives of their interests and reputation. No difficulty will occur in the application of these remarks, when it is pointed out that the letters signed 'Clovis' emanated from the Gas Works, under the superintendance of Mr. Hutchison, the engineer, and also a Member of the Company; and that they were written by a draughtsman of the Company, who is employed under his control. Under great provocation I have distinctly repudiated recriminatory expressions against the Chairman and leading Members of the Company. The continuance of that forbearance must now depend upon circumstances. Had I used any expressions personally offensive to these Directors (of whose names I am ignorant, though mine is before the public), I should be most anxious to retract them. On the other hand, having traced the letters signed 'Clovis,' to persons in their employment, I must, through you, assert my right to an explanation from the Directors of the London Gas Company, whether they intend to adopt or disclaim the statements of those letters, and the conduct of their authors? I beg to add that I consider my right to an answer to this requisition to be strengthened, and not impaired, by the pendency of legal proceedings, which may be influenced by unretracted misrepresentations.

"HUGH FORD BACON.

"Fen Drayton, March 3, 1840."

"P.S.—Let me add that the threat of an action for a libel against you, conveyed, or rather insinuated, in Messrs. Foss and Clark's letter (my name being, as they well know, affixed to my communication) is not very consistent with my humble views of magnanimity, or even of common justice. You will do me the kindness to recollect that I thought it right to pursue a very different course towards you, having at once retracted a similar intimation against the Editor of the *Mechanics' Magazine*, the moment he undertook to trace the letters signed 'Clovis' (which are clearly false and libellous) to their true source. Let me also add, that the evasion of all the charges advanced by me, in answer to those letters (by a formal deprecation of discussions on litigated rights), comes with a very indifferent grace from a quarter in which these discussions *originated*, and were persevered in against my *repeated protests!* Those protests having been utterly disregarded, the letter which these individuals have thought proper to denounce as a libel, became an indispensable act of

self-defence against a systematic attempt to influence the cause of justice by fraud and fabrication.

"H. F. B."

[We beg to confirm Mr. Bacon's statement of the conduct pursued by him towards us with reference to the letters signed "Clovis" —and we subjoin a document which traces them to their source. In the autumn of last year Mr. Bacon applied to us for the name of the author of these letters, observing at the same time, that he wished to consider that person exclusively reponsible, and he satisfied us that the statements they contained were such as we should not have inserted, had our attention been more closely drawn to their purport. Our impression, from various circumstances was, that these letters had come from Mr. Hutchison, to whose patents they exclusively related, and we wrote to him to ask whether, in case an action were brought against us, the Company would support us in defending the statements therein contained. We receivedthe following reply.]

No. 4.

"London Gas Works, Vauxhall,
"24th October, 1839.

"Dear Sir,—In answer to your letter of yesterday's date, I beg to inform you that I am not the author of the letter of "Clovis" to which you refer, and consequently, any application to this Company, upon a subject with which (as far as the threatened action applies,) they are wholly unconnected, will be useless; and I see no objection to your disclosing the authority under which you permitted the insertion of the article complained of.

"I am, Sir, yours obediently,
(Signed) "S. Hutchison.

"J. C. Robertson, Esq."

[Finding ourselves left to bear the brunt of an action by those whom we believed to be morally, if not legally responsible for the statements of these letters, we made a search, when we found the several letters which accompanied them, and which are in the same handwriting as the articles, whence it appears that they were written by a Mr. Mc Rae, employed by the Company as a draughtsman under Mr. Hutchison. Of these letters it is only necessary to publish the following (No. 5) which introduced Mr. M. to our notice, and gained our confidence by the use of the names of gentlemen for whom we have the highest respect. This letter clearly shows (see the part we have printed in italics) that the articles in question were written, as might naturally be supposed, by the direction of Mr. Hutchison, who is alluded to as *"the inventor of the* Portable Lever." (See No. 648). The other letters are dated, according to Mr. Bacon's statement, at the "Gas Works, Vauxhall," under the controul of Mr. Hutchison.]

"Dec. 23, 1835,
"23, Moscow Road, Bayswater.

"Sir,—Should you consider the accompanying drawing and description worthy of publishing in your excellent Magazine, you will favour me by their insertion. I am now preparing descriptions and drawings of various improvements that have been introduced into the manufacturing of gas, which, if you will permit, I will forward to you.

"I did intend to call upon Mr. Loudon, of Bayswater, to solicit a letter of introduction to you, as I am known to that gentleman, I am also known to Mr. J. Robertson, who was for several years Mr. Loudon's assistant.

"*As the inventor of the Portable Lever would prefer the description being published in the form I have now written it, to the usual, and more regular way of addressing the Editor, and adding a signature; perhaps you will be kind enough to publish it as now sent, that is, without* a signature: *As the inventor is desirous of avoiding any thing in the shape of a puff.*

"I am, Sir,
"Your obedient servant,
"David M. Rae.

"To J. C. Robertson, Esq."

THE COLLEGE FOR CIVIL ENGINEERS.

[*From the Civil Engineer and Architect's Journal.*]

In this investigation, we shall enquire, first, as to the mode of education required by the profession; secondly, as to how far this is supplied; next, as to the merits of the proposed plan; fourthly, how it has hitherto succeeded, and what are its future prospects; and lastly, how far it might be rendered useful.

We have defined engineering, as a profession requiring two distinct faculties, the theoretical and practical, the inventive and the constructive. This is a view sanctioned by the highest authorities. The *Report of the Institution of Civil Engineers* for 1837, describes the engineer as a mediator between the philosopher and the working mechanic. In their Report for 1838, they say, "'The objects of the Civil Engineer are defined by your charter. and the council considering that the success and permanency of the Institution must depend, in a great measure, on the care exercised in admission into this class, have repeatedly considered this subject with the view of presenting some definite rules for the guidance of themselves and

others. It has appeared that they will be aided in this difficult task by adhering as much as possible to the two following conditions; either :—

"He shall have been regularly educated as a civil engineer, according to the usual routine of pupilage, and have had subsequent employment for at least five years in responsible situations as resident or otherwise in some of the branches defined by the charter as constituting the profession of a civil engineer; or, he shall have practised on his own account in the profession of a civil engineer for five years, and have acquired considerable eminence therein.

"It is thought that the first condition will include those who by regular education have done their utmost towards themselves for the profession, and that their subsequent employment in responsible situations will be a guarantee that they have availed themselves of the opportunities which they may have enjoyed.

"In the earlier days of the science of the civil engineer, such a condition would have been inapplicable; then the force of native genius sufficed to place the individual in that position of professional eminence which commenced with a Brindley and a Smeaton, and was in our own time exemplified in a Rennie and a Telford. To such, of whom there are many illustrious examples amongst us, the second condition is strictly applicable."

The profession, particularly in its present infant state, is ever called upon to provide for unexpected contingencies, to make new precedents, and supersede old processes. The last ten years has seen a new and important branch created, and scarcely established before it found itself, by new improvements, obliged to abandon all its former calculations, and follow new models. The profession, therefore, is well defined as of two classes, and as uniting two branches of instruction. The accessory portion of instruction is one common to most practical pursuits, and a part of higher education at the same time, consisting, as it does, of the mathematical and physical studies, it needs no excathedral inculcation, but admits of being attained by private study by those engaged in the practical department. Like literature, like the arts, it necessarily follows that its greatest names are not recruited from apprentices to the system, but from every class of society, it admits the collegian and the mechanic; every man, who feels himself called upon by the divine voice to a destined pursuit. Who have been our greatest engineers? not students from a college, or an apprenticeship, but the stone mason and the [b]lacksmith, the labourer and the millwright. Engineering is not like law, bound up in an endless mass of precedents, admitting few new cases, and fearful of diverging from established rules, but it is ever new, ever changing, ever supplanting the past, by anticipations of the future. It does not, like medicine, require the study of a complicated and little known machine, nor a special application of many difficult sciences to its own objects, it does not require mere judgment to apply old rules, but it perpetually encounters new cases, and applies new remedies. The records of its operations are hardly published when they become useless and superannuated; many branches are hardly sufficiently advanced to have any literature at all; consequently, for those seeking practical instruction, the workshop and the field are the only schools; the house cannot be judged by a brick, the sea cannot be measured by a bowl of water, nor can the operations of the engineer be taught on any other scale of truth than on that of the works themselves. The lawyer and the surgeon find no college allsufficient for their instruction, they find not even the court house or the hospital alone efficient, but under the care of the acting practitioner, they are obliged to seek the basis of their education. It is remarkable indeed that a departure should be attempted in this sound course, when other professions are even carrying it to a greater extent; so distrustful are the medical authorities of oral instruction, that they now require at their examinations practical dissections and manipulations.

Engineers may be classified under the following heads :—

1. Civil Engineers—Roads and Railways.*
   Canals.
   Bridges.
2. Mining Engineers—Mines.† Draining.
3. Marine Engineers‡—Ship Building.
   Harbours.
   Docks.
   Light-houses.
   Dykes.
4. Military Engineers.
5. Practical Engineers—Land Engines.
   Locomotive Engines.
   Marine Engines.
   Manufacturing Engines.

Subsidiary to these are Surveyors, Working Engineers, Locomotive Engineers, and

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* Ingenieurs des Ponts et Chausees, French.
† Ingenieurs des Mines, French.
‡ Ingenieurs des Travaux Maritimes, French. Water Staat, Dutch.

Steam Vessel Engineers. The instruction required for these classes, we consider to be a practical acquaintance with the details of the technical portions to be acquired under the guidance of practical men in actual operations, and a study of the accessory sciences connected with their pursuits. Ample instruction in the former department is to be obtained from the existing engineers; and with regard to supplementary education, numerous institutions exist, independently of the amount of knowledge communicated by mechanics' institutions and other sources. The Institution of Civil Engineers, and the Universities of London and Durham, and the Military Colleges grant degrees, and classes are formed in London at University and King's College, in those of Norwich, Chatham, Sandhurst, and Addiscombe, and Hanwell Collegiate School; in the Provinces, in the Colleges of Durham and Bath, the Cornish Mining School, the Scotch Naval and Military Academy, at Edinburgh, the Royal Dublin Society's School, at Dublin, the Agricultural School, at Templemoyle, King William College, Isle of Man, and Elizabeth College, Guernsey. The elements of surveying are taught in many of the schools for the middle classes.

We have now to consider the proposed plan of the College for Civil Engineers which assuming different principles, calculates upon supplanting the existing modes of instruction. These are given to the public in a pamphlet, the confusion and ridiculousness of which, for the present, we pass by unquestioned and unremarked. This prospectus boldly asserts, that with regard to the demand for efficient practitioners in civil engineering, not one of our Universities or public seminaries has kept pace with this want of the age, and afforded a suitable education for the aspirants in that new professsion;—the best answer to this is to be seen above. What they mean by the following, they themselves can best explain:*—"They are, in a great measure, responsible for the profits on our internal industry—on the average of which depend agricultural returns, and also by reaction, an increased demand for labour." The fundamental basis of operations is that the whole instruction both theoretical and practical, shall be given in the College. This, according to the account of its managers, includes the structure of railways, roads, canals, docks, locks, and harbours, improvement of rivers, clearing mines of water, and their necessary ventilation; the whole structure of the steam engine, land and water transport, architecture and general construction, naval architecture, mining, drainage, embanking, reservoirs, *light-houses, arsenals,* surveying, levelling, mineral boring, modelling, casting and forging, turning and boring. And what is to feed this multitude?—two loaves and five small fishes—a few professors of mathematics, drawing and latin, an architect, and some acres of ground at Hampstead!!! Is there any one so insane as to attempt to carry out such a scheme?—is there any parent so wasteful of his own money, or regardless of the interests of his child as to entrust him to such a school? In an arena, scarcely fit for a cricket match, are we to see exemplified the wonders of British art; here, by magic processes, are to be reproduced *ad infinitum* the Grand Trunk Canal, the Eddystone Light-house, the Steam Engine, the Menai and Waterloo Bridges, and Birmingham Railway, with its vallied cuttings, its Kilsby tunnels. and its hilly embankments. The Clifton Bridge would span the ground, the Camden Town Embankment, swallow up the soil, and the cutting to Euston Square take in the whole estate. "Philosophy in sport, made science in earnest. We are either to believe these delusions, or we must recognise the sad reality, children misspending their father's money and their own time on mimic railways, and gutter canals; expert in all the verbiage which a well disciplined memory can retain, and going out into the world the children which they came into the college. If this be the offspring of the Polytechnic School, an Institution which has flourished under some of the noblest men in France, we believe that, with indignation, they will disavow their bantling; if it be an imitation of Russia, it is an imitation rather of the barbarism, than of the grandeur of that nation; we know that no example in favour of it exists in any other country. In the workshops, South Wales, Birmingham, Glasgow and Newcastle are to be united; the steam engine is to be wrought, by boys, from the native ore into all its wonderful applications as a motive power. What more they profess to teach we know not; we know that all these things, even if practicable as toys, will fail to make engineers such as England has and England wants. The ignorance of the projectors is only equalled by their absurdity; the manner in which the design is to be carried out, is expressed by a synopsis of the course of instruction extending over a period of five years, in the first two years of which the pupils learn nothing of engineering, except surveying and levelling, their principal acquirement being caligraphy; in the second year we find these branches are taught in conjunction with mineral boring and draining, and the principles of Civil and Naval architecture. No progress has yet been made in engineering, but never mind, we can wait. The third year

advances to shaded and coloured drawing, to drainage, embanking, and conduct of running water, and the construction of roads; leaving, consequently, the whole instruction for the last two years. In this course, we find that the principal engineering works (*i. e.* treatises) of the English, French, and Germans are to be read. What those French and German works are we should very much like to know;—to the best of our knowledge very few works exist, except translations from the English. Among the *magna opera* of the last year, we find such terms as "a grand drawing, with plans, sections, and parts in detail;" "grand project for internal transport by land or water, with estimates;" "a memoir on some important question of civil engineering." The pennyworth of bread of these gallons of sack, is the examination and explanation of public works on the works themselves. The "*lucidus ordo*" of the synopsis must be evident to the most unsystematical; drawing and caligraphy interpolated between mechanics and hydrography; architecture between hydrography and physics, and the same impartial system is carried throughout. As to the workman's class, for which twelve guineas a-year is to be charged, the paltriness and inadequacy of instruction given, exempts it from notice. The pupils may be admitted into the high school at 14 years, and on going through the prescribed course of instruction, as any youth of moderate abilities and sufficient memory is sure to do, is turned out on reaching his eighteenth birth-day, a duly qualified successor of Brindley, Smeaton, Rennie, Telford, and Watt.

This system, we may observe, is a clumsy imitation of the Polytechnic School, and other similar institutions abroad, which are adopted in the imperfect state of instruction, to supply the want of a more practical course. In the Polytechnic or Gwerbe School, the student finds those models which he can find with difficulty elsewhere, but under the guidance of a Stephenson or a Maudsley, he learns in that school, which is the model to all Europe. In our pages will be found an account of the state of engineering abroad. What it is here all Europe tells; we boast the names of Middleton, Worcester, Hooke, Savery, Newcome, Brindley, Milne, Smeaton, Bell, Edwards, Arkwright, Rennie, Macadam, Bramah, Huddart, Trevithick, Telford, Woolf, and Murdoch; and among the engineers of the present day, Walker, Stephenson, the two Rennies, the two Brunels, Cubitt, Locke, Maudsley, *Tierney* Clarke, &c., many of whom enjoy *an European* reputation. Such are the *fruits of a defective* system; what has Europe to show against it? The same defective system prevails in the United States, where gigantic works of the engineers measure the continent from one end to the other.

As to what must be the result of the proposed system, we fear we can augur nothing very good; on one side they are deficient in strength, and on the other side they have to compete with powerful rivals. The plan of the College itself, and its details, have been rendered ridiculous by fantastic absurdities; the very first page of their prospectus is calculated to excite laughter—a College for Civil Engineers, plastered with the names of a set of Eton schoolmasters, as honorary members; unknown foreigners, as corresponding members; the prospectus is dashed throughout with unmeaning italics; the distinguishing absurdities of the Hone and Black Dwarf School; the vice of those who wanting strength of thought, make it up by variety of type. One of the professorships is to be held by a clergyman of the Church of England, another is the chaplain, and sectarianism is openly proclaimed in a building devoted to the national pursuit of science. Of what religion were the Marquis of Worcester and Watt? "The College is based upon the principles of the established Church." Church of England railways, Catholic steam-engines, and Presbyterian canals, whoever heard of such things? Could not the moral and religious instruction of the students be provided for without injuring the feelings of large masses of the population, by giving a preference to a minority? The food of the boarders will be of the best description, and every care taken of their health!—shades of Brindley, Arkwright, and Rennie, whoever heard of such superfluous nonsense! "No pupil can be admitted without a certificate that he has had the small pox, or has been vaccinated; and has no particular infirmity or contagious malady." "He must be able to read! and write! fluently, and be master of the first four rules of arithmetic!!" "Corporal punishment will not be permitted in the establishment!"—"Suppose a gentleman designs one of his sons, at the age of five years!!! to be a civil engineer."

As to the supporters of this College, we find many men of high title, but we look in vain for the support of any of the great men, who, by their engineering works, have contributed to their country's glory. Only three names are to be found qualified as engineers, none of whom are sufficient to attract of themselves public support. As to the professors, of whom, by the bye, there are none for engineering, it is saying enough for them to mention, that many of the names are respectable.

We are now come to another question of the deepest interest to those parents, who are so ill advised as to send their children to this rickety College, that is, what is to become of the lads when they have got their diplomas? Will they be employed by the present engineers in preference to their own pupils? Will they have greater weight with the public than men of acknowledged eminence? Will they be supported by the public like those who have received a practical education under first-rate men? Our impression is, that they will not, but that the lads will, after their five years of College education, and an expenditure of several hundred pounds, be obliged to pitch their diplomas into the Thames, and article themselves to those who know something of the profession. We earnestly call on all who may be tempted by the luring prosposals of destining children from the cradle, and hatching engineers with more than an Eccaleobian power, to pause and reflect on the waste of time and money which they must incur from any failure of this kind, and to hesitate before they become the victims of a few deluded theorists. So sanguine are the projectors, that they talk of entrapping hundreds of lads, and think nothing of a hundred engineers as the average produce of a year. This, according to our reckoning, would of itself produce three thousand engineers, besides those educated in other establishments;* and what is to become of the raw and ignorant youths?—those best will be able to decide who can coolly give utterance to such preposterous delusions.

As to the manner in which they are supported by the profession, it may perhaps be sufficient to refer to the men connected with it, but we have farther public testimonials in the declarations of the Institution of Civil Engineers. The liberality of their opinions we have already shown, so that anything emanating from them, carries with it the whole weight of their character, and is free from the imputation of interested motives. Their report for 1837, while advocating the necessity of supplementary instruction, states that much has at times been said respecting the establishment of a school of engineers, and many comparisons have been drawn betwixt the advantages possessed by this and other countries in this respect, but not for an instant to enter on the great question of the nature of a complete establishment under that name, it may with confidence be asserted, that this institution is in itself a school of engineers—a school not in the sense of the term where knowledge is forced upon the unwilling student, but one where the attentive student possesses remarkable opportunities of self-improvement by study and mutual intercourse. In the speech of the President, on opening the session of 1839, he calls upon the members to improve themselves, not by collegiate instruction but by mutual improvement; he says, there is now upon the table a prospectus for the establishment, on a large scale, of a college for civil engineers," leaving his hearers to form their own opinions upon the merits of such proposition.

That there is room for the establishment of a school of engineering on sound principles, it admits no question; but its sphere, although extensive, is very different from that contemplated by the present plan. Its advocates jump at once to conclusions, inspired by the ardent hope of obtaining large premiums, they jumble everything together, and mix up the practicable with the impracticable. Stephenson or Brunel carry on no trade in premiums of five hundred guineas, it would make little diminution in their incomes, if they had no pupils at all, but young men are sent to them because, from their employment in large works, they have great facilities of affording instruction, and ample means of employing them afterwards. If the council of the college want to know what to do with their establishment, we can tell them how it may be made useful to the public, and profitable to themselves and their pupils. Let them require that every pupil in civil mining, marine or practical engineering shall be articled to a practitioner, and let them like University, King's, and Durham colleges, limit themselves to teaching the theoretical branches. Form a special class for instructing steam-vessel engineers, and they may claim a government grant, and a class for locomotive engineers, and railway companies would probably contribute. Educate surveyors, and instruct them in the higher branches of geodesiacal operations, not as planned by the college, merely the rudiments of astronomy, but its application in trigonometrical surveying. Give supplementary education to mining engineers, and train up mineralogists and assayists. Teach like King's College, the literature of manufactures and machinery, but let the pupils study in the factory instead of the toy-shop. Do the same for the manufacturing chemist, London has establishments enough for his practice. Let the Universities or the Institution give the diploma, and limit the college to teaching,

* As to how they are to support the competition of the engineers and existing colleges, its managers may know better than we pretend to do. They will be able to solve whether Everett, Webster, Wallace, and Elmes, are equal to De Moran, Silvester, Lardner, and Graham, or to Hall, Moseley, Daniell, Wheatstone, Phillips, Bradley, Cooper, and Tennent.

and still will be done more than enough for a beginning, and what will amply pay for all expenses.

In concluding these remarks, we cannot too strongly repeat, that parents should hesitate before they compromise the interests of their children, by sending them to this establishment, and we call on its managers to pause in their career, before they have yet excited the open hostility of the profession, and to devote their energies to a useful and rational purpose, before they are crushed by a powerful opposition. We have been influenced by no prejudice against the college or its objects, but we feel that we have best done our duty both to it and our readers, by unsparingly denouncing what we consider an erroneous and inefficient system of education, and a certain delusion to those who have the misfortune to be its victims.

ANTHRACITE COAL FOR STEAM-ENGINE FUEL—EXPERIMENTS.

The Anthracite Patent Company engaged Mr. Josiah Parkes, C. E., and Mr. Manby, C. E., to make experiments on the evaporative power of anthracite coal. The following report of the results has been published.

Report.

In compliance with your wish that we should not delay our experiments on the evaporative power and other qualities of anthracite until a boiler should be erected on shore of greater magnitude than that on board the steam-vessel, but proceed at our earliest convenience to ascertain the calorific value of this fuel as applied to the boiler of the steamer, we now beg to furnish you with the results of such experiments and observations as several days' practice has enabled us to make. It is necessary to state that this boiler is obviously one ill-calculated to develop the full effect of fuel of any kind, owing to its shortness and restricted size, in consequence of its having been made expressly to suit the dimensions of the vessel. Our experiments also on the relative weights of water converted into steam at different rates of combustion, were limited by the moderate draught of the low chimney and the tubular construction of the boiler. We have, nevertheless, obtained results satisfactory in many points of view, and which cannot but be useful in supplying data for better proportioning the furnace to the boiler, as well as for the most advantageous mode of constructing marine boilers intended to employ it. The following experiments will suffice to illustrate the power of anthracite and the qualities of the boiler operated on:—

—	Coal Burnt per Square Foot of Grate per Hour.	Water Evaporated from 212° per Hour.	Water Evaporated from 212° by 1 lb. of Anthracite.	Water Evaporated from 212° by 112 lbs. of Anthracite.
	lbs.	lbs.	lbs.	Cubic Feet.
Experiment 1	14.86	1963.89	6.50	11.66
,, 2	12.65	2240.00	8.25	14.86
,, 3	3.18	833.02	12.27	21 99
,, 4	2.94	867.44	13.48	24.18

The water was accurately measured into the boiler from a tank in the engine-room, and the temperature of each quantity noted, which varied greatly on different days; but it being necessary to dispense with the water ejected from the air-pump, and to use only that from the river, the amount of evaporation has been reduced in each case to that which would have taken place had the water entered the boiler at 212°. The assumption of a common temperature for the feed-water in these experiments is necessary for the purposes of a just comparison, and enables us to compare the work done by the anthracite with that performed by bituminous coal in other boilers, the water of supply being similarly reduced to the standard of 212°.* Before entering on a comparison of these experiments with others on bituminous coal, we will note that the second experiment accords with the rate of combustion and evaporation requisite to work the engine. A trial of strong foundry coke from Pontop coals gave the same results, but was attended with the disadvantage common to the use of coke generally in rapid combustion, of forming a heavy clinker on the fire bars. In other respects the coke was efficient; it descended equally well with anthracite through Mr.

*See Transactions of Institution of Civil Engineers, vol. ii, pages 178, 179, for table and formula of reduction.

Player's feeding tubes, and spread itself with equal uniformity over the grate. Having ascertained that the boiler was of insufficient size to absorb the whole heat of the fires whilst the engines were working, we sought to obtain such positive results by simple evaporation as would demonstrate the real calorific value of anthracite. This end has been accomplished, to a certain extent, by applying a temporary damper, so as to diminish the current of air into the fire and through the chimney, and detain the heat longer about the boiler. Experiments 3 and 4 give the particulars of the effects arising from thus diminishing the rate at which the heat was produced and expended. By comparing the 1st with the 4th experiment it will be seen that more than one-half the heat was uselessly generated in the first case, and that it passed through the tubes of the boiler without performing any service, the chimney being wide open. In the last case about two-thirds of the area of the chimney was closed. An inspection of the results will show the enormous loss which attends rapid combustion in so short a boiler; the tubes which convey the heat from the fire-boxes into the chimney being only three feet in length, and the entire distance traversed by the heat only six feet four inches. In consequence of the short duration of the heat within the boiler, it was transmitted through the chimney in the 1st and 2nd experiment at a temperature capable of melting zinc; and a mercurial thermometer, inserted from time to time into the chimney beneath the damper, only once exhibited the temperature of the escaping caloric so low as 450°, it being generally higher than the boiling point of mercury, even in the 3d and 4th experiments. Comparing the mean of the two highest with the two lowest experiments, it appears that by increasing the rapidity of combustion in the ratio of 4.37 to 1, the evaporation in equal times was increased only in the ratio of 2·50 to 1, whilst the evaporative product from equal weights of coal was diminished in the ratio of 1.74 to 1. Recorded experiments with Welsh coal, in Cornish boilers, show that at the same rate of combustion as in our 4th experiment, viz., 2·94lbs. per square foot of grate per hour, the evaporative produce was 21·31 cubic feet from 212° by 112lbs. of coal, or 11·89lbs. by 1lb. of coal,† Under like rates of combustion, therefore, the anthracite exceeded the Welsh coal in the ratio of 13·48 to 11·89, or by 13 per cent.; but the relative areas of the heat absorbing surfaces, the period of the duration of the heat about those surfaces, and the radiating condition of the exterior of the respective boilers—all which circumstances materially influence the realization of high evaporative product—are so much in favour of the Cornish, compared with the *Anthracite's* boilers, as to justify the inference, that if our experiments could have been conducted under equally favourable circumstances with those on the Cornish boilers, the results would have been considerably greater than those we actually obtained. This will be evident on a comparison of the boilers which have given these relative effects. The Cornish boiler presented an area, of 961.66 square feet, and the *Anthracite's* boiler 340 square feet, to receive the heat generated from equal weights of coal and of anthracite in equal times $=2·549$ to 1 in favour of the former. The rates of combustion, and consequently the velocity of the current of heat from the grates, were equal. The distance passed over or circuit made by the heat after quitting the grates was 152 feet in the Cornish, and three feet in the *Anthracite's* boiler; and the period of the duration of the heat about equal surfaces of the two boilers was 2½ times longer in the Cornish than in the *Anthracite's* boiler. The Cornish boiler was enveloped in good non-conducting substances, that of the *Anthracite* had little or no defence against loss from radiation. Considering these differences, and their influence over evaporative economy, we are of opinion that under equal circumstances anthracite would greatly exceed the best bituminous coal in calorific value; it having already given, even under comparatively unfavourable circumstances, a result greater by 13 per cent. than any on record. The highest known evaporative product from Newcastle and Staffordshire coal, is 10·32lbs. at 212° by 1 lb. of coal obtained at Warwick,* and the boilers there employed were worked with precautions which leave little room to believe that those results from the same coal can be much surpassed in common practice. Our 4th experiment with anthracite, (subject to nearly the same disadvantages as those already mentioned,) exceeded the Warwick performance by 30 per cent. The peculiar construction of the *Anthracite's* boiler opposed obstacles to our recording any experiments on it with bituminous coal, because the tubes soon became gorged with soot, and the coal caked in such manner as to prevent the column in the feeding-pipe from descending and supplying the grates. We ascertained, however, on a short trip, by firing through the fire-door in the usual way,

† See Table of Boilers, experiment 1. Transactions of Institution of Civil Engineers, Part I, vol. iii.

* See Table of Boilers, experiment 5. Transactions of Institution of Civil Engineers, part I, vol. iii.

that coal (Pontop) maintained sufficient steam for the engines; and we must here observe that Mr. Penn's oscillating engines fixed in the *Anthracite* are very economical of steam for their power. With reference to Mr. Player's method of supplying anthracite to the fire-grates, we can only repeat the opinion expressed in our first report, that it is perfectly effective, dispensing, as it does, with all mechanical means, and with the labour of stoking, which is so severe in steam-vessels, together with the waste and injury arising from the common system of firing by the shovel through the fire-door. In no one of our experiments (excepting when the fire was purposely urged to excite very rapid combustion) was it necessary to stir the fuel or prick the bars during the day. No scoriæ was formed at the most rapid rate of combustion, and the quantity of residual ashes was very small. This method of supplying the fire is accompanied also by an advantage of great practical consequence, viz.: an uniformity in the production of steam which cannot be excelled. When working with the damper, (without which there can be no proper control over any fire,) our measuring water-tank, containing 400lbs., was emptied so nearly in equal times as scarcely to vary a single minute for hours together, the damper not being touched, and the coal descending upon the fire precisely in proportion to the rate of combustion determined by the damper. The advantages arising from the peculiar circumstances of anthracite producing no smoke or disagreeable effluvia, or causing any soot to fall upon the deck, are too evident to be further dwelt upon.

"JOSIAH PARKES.
"CHARLES MANBY.

"London, January 20, 1840."

NOTES AND NOTICES.

Pocock's Patent Flexible Asphalte Roofing.—A novel manufacture is offered to the attention of the public, called "Flexible Asphalte Roofing." It is intended to supersede the use of slates, tiles, zinc, thatch, &c., in the covering and lining of farm buildings, sheds, cottages, and other erections, and from its durability, lightness, and economy, it is expected to be brought into very general use. The weight of this manufacture being only 60 lbs. to the square of 100 feet, the walls and timbers to support it are required to be but half the usual substance; it is also a non-conductor of heat, impervious to damp, and will bear a heat of 220 degrees without injury. Several architects and railway engineers have, we understand, already adopted the asphalte roofing for sheds and other buildings; and we are informed that the roofs of the Slough Station on the Great Western Railway will be covered with this material. The patentees finding that the old hair-felts with pitch and tar, entirely fail, by yielding to the pressure, on iron railways, have invented a composition to supersede the use of felts, which has been adopted on the Great Western Railway, and highly approved of for its peculiar property when laid down, of remaining fixed and unalterable.

Uses of the Diamond in Manufactures.—It was a singular fact, that the natural point only of the diamond would cut, as that obtained by polishing was found to be useless in cutting glass. Besides this useful purpose to which the diamond was applied, it was also employed, as well as the sapphire and ruby, in wire drawing, producing by its hardness the most perfect uniformity; it was said that Mordaunt's ever-pointed pencils were made by drawing them through perforated diamonds, but this was not the case, although he believed they were drawn through sapphires and rubies. The diamond had been used as a substitute for steel in engraving, one of the noblest improvements ever made, as they would find by a close inspection of the works of Finden and others.—*Murray's Lecture on the Diamond.*

Symington's Seaman's Life Preserver.—Mr. Andrew Symington, watchmaker, Kettle, has lately invented what he terms a "seaman's life preserver," one of which has been examined by several persons of experience, who give it as their opinion that it seems well calculated to accomplish this humane and praiseworthy object, and that it cannot fail, when introduced, to be of great importance to fishermen and all those who may be exposed in open boats to the perils of the sea. Mr. Symington has accomplished this much desired object in a peculiarly constructed jacket or belt, which can be bound at pleasure round the waist of any person; it is quite light and flexible, so as not to produce the least inconvenience to the wearer, and when immersed in water, its buoyancy becomes so powerful that it will not only keep the head above water, but also part of the shoulders, and preserve the body afloat for a great length of time. We cannot but express our hope that the Admiralty, as well as those societies whose object is to encourage such praiseworthy endeavours, will not be slow in duly rewarding Mr. Symington for this simple but valuable contrivance.—*Fife Herald.*

The New Saw Setting Instrument.—Sir,—I did not intend to make it appear that I was the inventor of the saw-set, but finding such a useful article was not generally known, I wished to make it public, and I think if your correspondent ϕ had properly understood what he read in No. 862, he would have found it the reverse to what he states in No. 864; I said, "I have at length succeeded in obtaining a saw-set that is made upon a principle which I have long since anticipated would answer well." The one that I have got was made by Burton, of Sheffield. The fact is this, I have been about inventing a saw-set for a year or two, and some novel and useful articles were the result of my labours; one was made by Mr. Hammond, a smith, which was a block of steel with a bevel edge, with movable rack and pins to suit all sized saws, and give them more or less set; the saw was struck by a swivel hammer. During the last year I invented several others; the last was one like a shoemaker's punch, only that instead of a hollow tube which pierces the leather, there was a solid triangular piece of steel, and an indent in the bottom plate to receive the tooth of the saw, and was so contrived that I could give more or less set to the saws: and this is exactly, in principle, like the one in question; of this, I only made drawings, and part of a model; on endeavouring to get the article made, I was informed that I could get one very much like it by applying to the ironmongers in the town; I applied to W. Couch, ironmonger, and he obtained the article in question, for me; and I think after this explanation no one, for a moment, will consider that I lay any claim to the invention of the saw-set in question.—I remain, &c., H. MOREHEN. 4, Regent-street, Cambridge.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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PLATOW'S PATENT AUTOMATON COFFEE URN.

PLATOW'S PATENT AUTOMATON COFFEE URN.

Sir,—Our time has been called the "reading," sometimes the "thinking," age, with what truth we must leave to the final judgment of posterity, but if we assumed the simpler title of the "coffee drinking" age, the designation would perhaps be more accurately descriptive of a great and gratifying change in our habits and sentiments, which has doubtless commenced and is rapidly extending, though it may not yet have thoroughly pervaded all classes of society. How different are the feelings with which habits of intemperance are now viewed among our wealthier classes, compared with the toleration and even favour which was conceded to them within some thirty years of our present times! The race of the Squire Westerns of the last century is nearly extinct; their *bonhommie* would no longer now be admitted in refined society as an apology for their grosser vices. But what is still more gratifying is the commencement of a similar change which is now strikingly visible amongst the very humblest ranks of the community. Voluntary oaths and pledges may perhaps be considered as dubious acts of morality and wisdom. But what great improvement has ever yet occurred in the world's history without some admixture of error, and when were large masses of mankind led to great and wholesome reformation without the powerful aid of enthusiasm, which can only be excited by an appeal to the highest feelings? Feeble, therefore, must that man's judgment be who considers the rash vows which are sometimes (but not always) exacted by societies formed for suppressing the use of intoxicating liquors, as a reason for treating with scepticism or indifference the undoubtedly beneficial results which the advocates of temperance have produced in England and America, and the striking effects which have attended the pure and benevolent efforts we have lately witnessed in Ireland, to rescue the fine but destitute people of that country from the baneful influence of one of the most pernicious symptoms of the degradation and misery in which they have hitherto remained. Among the improvements in *the arts* connected with these milder *stimulants* which have in many quarters *nearly* supplanted the use of ardent spirits, may be mentioned the ingenious discovery referred to and described at the head of this article. The object of this invention is to make *good* coffee, and clear it by a self-acting process; nothing can be more simple than the operation. The machine consists of two parts: the glass vase, A A, which surmounts the urn, B B, screws off and on by means of the wooden handles, C C, and is furnished with a long narrow and straight tube (not shown in the drawing) resembling the pipe of a common funnel, and reaching nearly to the bottom of the lower vessel, B B. The following is the method by which the coffee is prepared. Boiling water is poured into the glass vase in quantity sufficient to make the coffee required. The upper vase screws *air-tight*, by means of a felt washer, and therefore in order to let out the air within the urn, which would otherwise prevent the water from descending, the screw must be slightly relaxed. When the water has gone down, the vase is screwed tight again, and the ground coffee is placed within it, on the perforated silver plate fixed water tight, as shown at *d d*. Then the lamp, E, (containing spirits or naptha) is lighted and placed under the urn. In a short time steam will be formed on the surface of the water within the urn, and by its elastic pressure will necessarily force the water up the tube before referred to into the upper vase. It will there continue in a state of ebullition, and boil the coffee so long as the heat which generates the steam is kept up; but so soon as the lamp is removed, (which is to be done when the coffee is considered sufficiently boiled) then the steam within the urn instantaneously condenses, by which means a partial vacuum is formed, into which the weight of the atmosphere strains the coffee liquor, first, through the coffee grounds (which are compressed into a cake by the process,) and then through the perforated silver plate. The urn is thus filled with the pure bright and fragrant decoction of the berry, fit for immediate use.

The lamp is applied only to the coffee urn in its more ornamental and elaborate shape; a simpler and more common coffee pot may be used for placing on a fire, stove, or gas lamp, in which case the coffee-pot must be removed from the the source of heat, so soon as the decoction

is complete, and the filtering process will then take place as before.

Having thus described the mechanical construction and action of this coffee-making machine, which, from its self-acting principle, is fancifully called the "*Automaton,*" by the inventor; perhaps your readers will not deem a few remarks irrelevant for the purpose of explaining in what manner its peculiar action is supposed to extract from coffee those qualities for which the beverage is distinguished and prized.

Coffee when properly prepared is a highly palatable and exhilarating drink. But in England we hardly ever meet with it in perfection. In the small coffee shops frequented by the humbler classes it is a thick, coarse, black, muddy draught of a very uninviting taste and appearance; in most of our inns and hotels it is a liquid of most variable colour, consistency and quality, and even in the dwellings of the wealthy and refined, the art of making *good* coffee is rarely understood as it is on the Continent. Dr. Donovan, the author of the interesting work on Domestic Chemistry, published in Lardner's Cyclopædia, has proved, that, there are two principles in coffee which may be entirely separated from each other, its aromatic flavour, and its stimulating or medicinal properties, to which are ascribable its agreeable effects on the spirits. Now it is obvious that the art of making good coffee must consist in obtaining a union of these two properties in the highest possible degree. Where great care is used, *combined with skill and experience,* (for, these are as much needed in this apparently simple process as in more ambitious ones!) the object may be attained by the usual mode of boiling. But ignorance will rarely submit to be enlightened, or prejudice to be removed, especially on subjects which appear to be so simple, that an offer of instruction is deemed an officious intermeddling! To Dr. Donovan the decoction of a cup of coffee may appear a nice chemical process, on which even philosophers may have something yet to learn; but to the inexperienced cook, or raw barmaid, this seems a very trifling matter, or at all events, it must be left to their sovereign and exclusive control! Now the great advantage of Mr. Platow's invention is, that in the making coffee the services *of these fair* and amiable, but not always very tractable ministrants are dispensed with! The "*Automaton* Coffee Pot," as the name imports, does its work without the aid either of the fair or the less worthy sex! In truth, it is a little steam-engine. The following may be enumerated as the characteristic benefits of this invention:—

1. Owing to the rapidity with which the coffee is extracted by the means above described, the medicinal or stimulating quality of the berry is obtained and the aroma is also preserved.

2. The coffee is always of a clear and bright amber colour and does not require fining.

3. The result, depending as it does, on unerring physical laws is, and must be uniform, and the coffee can never be spoiled by the unskilfulness or carelessness of servants.

To compare small things to great, the "*Automaton* Coffee Pot" is to coffee-making what Humphry Potter's accidental discovery was to the steam-engine. The most skilful engineer could not adjust the supply of steam with the same accuracy as the self-acting valves, and the most careful preparer of coffee (according to the old method) will generally find himself beaten by the self action of Mr. Platow's improvement.

Having said so much of the "philosophy" of the "*Automaton* Coffee Pot," (for which I owe an apology to your fair readers, to whose province the invention especially pertains!) let me add a few words on its lighter attractions. These are by no means to be overlooked even with reference to the solid ends of practical utility. Coffee, when extracted according to the operations generally received cannot be agreeably or conveniently made in the parlour; it must be left to the fair Hebes before alluded to! But Mr. Platow's improvement (in consequence of the *simplicity of the principle on which it acts*) enables the lady of the house to make coffee *with her own hands* without the aid or interference of servants. Hence the apparatus is generally so constructed as to render it ornamental, and the process of extraction —which is distinctly visible through the glass vase, has a pretty and agreeable effect, not unsuitable to the breakfast table or the drawing-room of the most refined. A short time after the lamp has been applied, the hot water is seen rising

suddenly into the glass vase bubbling and swelling like a hot fountain in miniature. But no sooner is the lamp withdrawn, than the current is reversed, and the filtered coffee appears running down into the urn in a rich transparent stream. These abrupt transitions in the process and the rapidity with which the coffee is obtained in perfection, make "the *Automaton*" and its exploits a subject of interest and amuzement—a pleasing toy alike to the philosopher and the child!

Your obedient servant,

SINBAD.

ON LONG AND SHORT STROKE STEAM-ENGINES.

Sir,—My attention has been frequently turned to a subject of some importance, and one which has been the occasion of much *talk*, but which in my opinion has seldom been discussed upon correct grounds; and as I am not aware that it has been investigated in your valuable journal, perhaps you will allow me to invite some of your correspondents who are engineers, or who are otherwise interested in the matter, to thoroughly examine and decide beyond any further dispute the question at issue; which is—what proportion should the length of the cylinder of a steam-engine bear to its diameter?

The comparative merit of long and short "strokes" has been a matter of much speculation among engine builders, scarcely any two of whom agree as to the best proportions of a cylinder, and few of whom it is to be feared ever take the trouble to go into an accurate calculation of the useful effect produced by cylinders of equal cubical capacity, but of different proportions—they are rather guided by experience and observation, both of which it is allowed are indispensible requisites in an engineer, but neither of which in the present case can prove either the one fact or the other; and as the question certainly is one which admits of mathematical demonstration, an appeal should at once be made to so impartial and unerring an umpire.

Singular as it may appear, the greatest disparity exists upon this point among engineers of the highest rank—those who build marine engines, in which the smallest change for better or for worse is in the end attended with important results. It is well known that American engineers have for several years been gradually adding to the stroke of their marine engines until they have reached the enormous length of eleven feet and upwards. English engineers on the contrary, have been constantly reducing the length of their cylinders from the proportion originally assigned by Watt, until it is rare to see a marine cylinder whose diameter is not greater than the length of the stroke.

For anything like an exposition of the causes which have led English and American engineers into such opposite extremes—extremes too, which are every day becoming wider, I have looked in vain—Mr. Stephenson's work,* although containing the fullest and most correct account of this branch of American engineering yet published, fails to assign any adequate reason for using cylinders of such extraordinary length. As an American, however, I cannot but admire the candour and impartiality which pervades this book. Even in the instance just alluded to, his attempt at an explanation seems to have been in some measure intended as an apology for one of Jonathan's "notions," which it is evident he could not clearly see through; but while looking in vain for a satisfactory motive which he might attribute to American engineers for giving their engines such proportions as have always looked strange to English eyes, he gave that which seemed to be the most plausible. He seems, however, to be a *long stroke* man, and evidently approves of long cylinders wherever he thinks them admissible, as in the case of the American river boats, and like many others, attributes the short stroke of the English engines to the necessity of keeping them below deck, in consequence of the exposure of English boats to heavy weather.

Now, if long cylinders possess any advantages over short ones for river navigation, I see no reason why they do not possess equal advantages for sea-going vessels—neither do I see any obstacle to the introduction of cylinders of any required length into such vessels whenever it shall appear that increased length is

* Sketch of the Civil Engineering in North America, by David Stephenson, Civil Engineer. London: John Weale.

desirable. The U. S. steam frigate *Fulton*, a vessel of only 800 tons, is fitted with engines of eight feet stroke, and yet her works are entirely below deck. If increased length of stroke be desirable, why not at least adopt it on board of the Thames river steamers.

Mr. Stephenson's explanations seem the less satisfactory, since he has quite overlooked the fact, that while the American boats upon the unrippled surface of the Western waters are worked by horizontal engines, snugly stowed and not remarkable for their length, those upon Long Island Sound, which are partially exposed to the sea, and occasionally encounter very heavy weather are worked by engines with a stroke of from ten to twelve feet; while the boats which ply between the city of Boston and the various ports "down east," over a tract of sea coast, which for boisterous weather is second only to Cape Hätteras, are propelled by engines of a still greater proportionate length; and although light boats, have long been known for the regularity of their passages.

From these data, then, it would seem that neither Mr. S. or any of his predecessors have succeeded in throwing much light upon the point in question; for it appears, that in proportion to the degree of exposure to be encountered by American boats had been the increase in the length of their engines. It is also a fact well known to travellers, that the best and steadiest sea boats upon the American coast, are those which have the upper works of their engines considerably elevated above the deck, and their boilers upon the guards, and it is not improbable, that whenever Jonathan gets money enough to send sea-going vessels to foreign ports—the first object to be descried at sea will be the beam of the engine half way up to the mast head.

The opinion entertained by Mr. S., that an increased length of stroke enables the engine, when working singly, to pass the centres with greater certainty, is entirely without support; for the piston, piston-rod, and connecting rod, however heavy, and although moving at an increased velocity, cannot, by their *inertia*, contribute in the slightest degree to assist the engine over the centres; besides which, the wheels of the American boats are generally so large and heavy, and *move at such a velocity*, as to render any *further aid superfluous*.

Prof. Renwick, of New York, in his paper on American Steam Navigation, contained in Tredgold's work, seems to have been aware that his English readers would expect some explanation in relation to one of the most remarkable peculiarities of the American boats; but, unfortunately, in his eagerness to attribute the speed of those boats to the use of long cylinders, he has fallen into an error of the grossest kind, for which he will get few thanks from American engineers, who may well exclaim "Save us from our friends!" The Professor has mounted the old hobby so often ridden —that of *gaining power* by increased leverage, or, as it is often termed, "*causing the steam to act at a more favourable point*." A blunder like this now-a-days from a Professor is not deserving of correction.

Enough has been said, I think, to show that long or short cylinders have very little to do with the seaworthiness of a vessel, and that American engines have been lengthened or English engines shortened for reasons which have not been sufficiently explained; indeed they cannot be fully apparent so long as our only data is derived from statements put forth in the heat of rivalry by parties who are ready to go *all lengths* in support of a favourite or preconceived theory. Trusting, however, that a careful consideration, upon *correct principles*, of the question previously proposed, will open the eyes of all who are not wilfully blind, I, for the present, leave the subject in abler hands.

I have the honor to be, Sir,

Your obliged servant,

AN AMERICAN MECHANIC.

WIRE ROPES FOR MINING PURPOSES.

Sir,—In compliance, with a request for information with respect to wire ropes, expressed in a letter signed "E.," in No. 864 of the *Mechanics' Magazine*, I may mention, that Count Brenner in appropriating to his countrymen the invention of wire rope and its application to practical purposes, has been guilty (perhaps unknowingly) of injustice, provided it was not so applied in Austria, more than five years ago. Sir, about this period Mr. Smith, engineer, Princes-street, Leicester-square, took out a patent

for the manufacture of metallic rope to be applied to the standing rigging of ships, and to be used in mines instead of common hempen cables; and more than this, some of Smith's experiments, I am given to understand, date as far back as the year 1825; whilst I saw in Mr. Smith's shop. some of the manufactured rope in 1833, five years before the reading of Brenner's paper at Newcastle-upon-Tyne.

About a year subsequent to the taking out of the patent, Smith's wire rope was tested by order of the Lords of the Admiralty in Woolwich Dockyard, and on account of the very favourable results of the different experiments, it was employed to form the standing rigging in several ships of war. The trial has been satisfactory both in this and in other instances in which the rope has been so used. This I can assert positively, as I have perused certificates from several captains of vessels who speak very highly of its merits, and do so experimentally from having tried it in every clime.

In several mines, in this country, I am led to believe Smith's rope has been introduced, and its adoption has been signally successful. Respecting the comparative expense and strength of wire and hempen ropes, it would expand this letter too much to make any statement (see Moseley's Illustrations of Mechanics, page 49); but all necessary information with regard to the experiments performed at Woolwich with the chain-cable testing machine, will, I make no doubt, be willingly given upon application to the patentee.

I am. Sir,

Your obedient servant,

D. L.

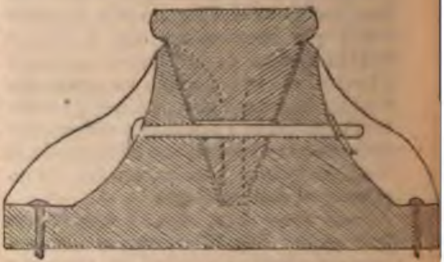
Cheam, Surrey, March 3, 1840.

PERKIN'S AND CO.'S POST-OFFICE STAMPS.

Among the designs furnished for post-office stamps, those of Messrs. Perkins, Whiting, and Sievier have been most noticed. It is due to the last gentleman to mention that it is understood with him the idea of blending several colours originated. To imitate the stamp he has submitted, the forger must combine the die-sinker, the engine-turner, and the mechanic. Mr. Sievier has invented a machine which will print with such rapidity that a million of impressions may be obtained daily, presenting an elegantly embossed head and border, in itself, as a work of art, worth more than the sheet of paper on which it will appear, for the trifling charge of £6 5s.

EMSLIE'S IMPROVED RAILWAY.

Sir,—The annexed sketch is intended to illustrate a plan which occurred to me some time since, for obtaining a greater stability for rails on railroads, and should it prove worthy of a place in the columns of your valuable Magazine, I shall be delighted.



My leisure time being short, I must necessarily be brief. The sketch, I think, will readily exhibit my views. The seat of the chair is angularly shaped, and the rail, or the rail at the seats, adapted thereto. Through the cheeks of the chair, as also through the rail, are holes, through which, on the holes in the rail being brought down to a level with those in the chair, a bolt or key is to be driven. Between the rail and the chair a thin piece of felt would probably be advantageous, a considerable weight being placed upon the rail to compress the felt, gives the rail a good bed, and brings it down to its proper place for the key to be driven. The slit for the key, through the rail to be wider than the key, to allow for the expansion and contraction of the iron.

At the joints the chair would require to be enlarged, for the end of each rail would require a seperate key.

The rail may be altogether wedge-shaped, or only so at the seats; in the former, the iron would not be disposed for obtaining the greatest strength—and in the latter, some difficulty would occur in rolling the rail, which, I have no doubt, might be easily overcome.

I shall be happy to be permitted to continue these suggestions at an early opportunity.

I am, Sir,
Your obedient servant,
J. A. EMSLIE.

Stockton-on-Tees.

OMNIBUS VENTILATION.

Sir,—I make no apology for offering the following hint to the notice of your readers, for if any class of contributors deserve indulgence, they surely may, whose aim is to abate a public nuisance; and all frequenters of our public vehicles will, I think, agree that the foul air of a crowded omnibus in the winter season, is a serious evil. Nor does it seem possible sufficiently to ventilate these vehicles except by mechanical action, the only opening of any consequence being in the most unfavourable position possible for changing the air.

I propose, then, to introduce a fan-wheel, revolving within a hollow drum, in the fore part of the body, below the driver's seat. It would be entirely concealed by the mahogany lining, which might be perforated with an ornamental pattern. A trunk or chimney would be conducted to the roof. One of the fore-wheels would be the prime mover of the fan, sufficient velocity being gained by the interposition of a multiplying wheel. The consequent equalization of the value of seats would in itself be no small benefit. And be it observed that the power of draught increases with the exigency of the travellers; for the more does the vehicle depart from a state of rest, the less possibility is there of a breath of fresh air finding its way into it.

I remain, Sir,
Your obedient servant,
OXYGEN.

London, March 6, 1840.

ENGLAND'S PATENT UNIVERSAL SCREW JACK.

[Communicated by the Inventor.]

The above is a perspective view of the Universal Screw Jack. A, representing the common lifting jack placed on a strong iron frame B, with the screw C, the whole length of the frame (about two feet) working in bearings at each end, and through the double nut D D, attached to the base of the jack A, the screw C, being worked by the rachet lever E, will cause the jack to traverse the length of the frame, carrying with it any body that may have been lifted by it.

The Universal Screw Jack has been approved of and patronized by the following eminent engineers:—Messrs. J. K. Brunell, R. Stephenson, J. Braithwaite, J. U. Rastrick, E. Bury, and J. Gibbs.

It is particularly applicable to railway purposes, as in all cases it answers the purpose of the common lifting jack, and also embraces the advantage of a lateral motion, by which the operator can with facility move a body laterally after it has been raised vertically; as in cases of engines or carriages being thrown off the line of rails, by applying the Universal Screw Jack, they can be replaced in a very short space of time compared with that required when the ordinary jacks are used.

The object of the inventor is to carry one with every train, so that in case of an accident occurring on any part of the line where there is great difficulty in obtaining assistance, the engineer and his assistant will be sufficient to set to rights any accident of ordinary description in a very short time with the assistance of the Universal Screw Jack.

They may be seen in use upon most of the railways diverging from the metropolis.

WELLER'S GAS-COOKING APPARATUS.

Sir,—I have sent a sketch and description of an apparatus for cooking with gas. I should esteem it a favour if you would inform me, through the medium of the Magazine, whether, in making the article in question, I am infringing on any patent; I have made some inquiries, but have met with only one patented article, which is only for *roasting* by gas. This is by Mr. Robert Hicks, and is thus described by the patentee:—"The object of this invention is to *roast* meat by the flame of ignited gas, that heat being confined under a *conical cover*, which is placed as a screen over a circular burner, and the *meat to be cooked is mounted upon a vertical spit* in the centre of a circle of gas flame." This apparatus is for boiling, though it may be used occasionally for baking. The apparatus is made to stand in a fireplace, or in a recess by the side of a fireplace. It is for summer use when a fire is not wanted, except for cooking; and I find that for *boiling* with this apparatus gas is cheaper than any other fuel, and possessed many advantages besides. The apparatus is made with a union joint between the vessels and the top, to attach and detach it with facility. The tap should be made also to turn with a key, to prevent children and others from interfering with the supply of gas to the burner. To the apparatus may be attached rims to admit different size vessels. I have one rim to the one described to admit a tea kettle.

It is found that gas estsblishments (in country towns at least) are at the same expense nearly in summer as in winter, and the revenue not more than one-third as much: in fact, the summer half-year does not pay the expenses. If apparatus for cooking with gas for summer use were generally used, it would lead to great reduction in the price of gas, and thus secure a cheap method of cooking in summer, and cheap light in winter.

I am, Sir,

Yours, respectfully,

W. WELLER.

Battle, Feb. 20, 1840.

Description.

Fig. 1, longitudinal section of the apparatus. A, the outer vessel, 7 inches deep, round the bottom of its side are holes for the admission of air; B, upper rim of outer vessel, near the top of which are holes for emission of air; this is a separate piece fitting on the outer vessel in the manner of a lid; C, the inner vessel containing the gas burner, it has four iron legs $\frac{3}{4}$ of an inch long, its bottom is the size of the outer vessel, but there is a space of $\frac{1}{2}$ an inch between its side and the outer vessel; it is five inches deep, and on its bottom lies the gas-burner which is an oval ring of $\frac{1}{4}$ inch iron pipe having 24 small jet holes on its upper side, the service-pipe is fixed to the oval burner and passes through both vessels, on the outside is a union joint by which it is attached or removed from the external service-pipe G, the bottom of this vessel has two rows of holes, one inside the other outside of the oval burner, which furnish air from the lower part of the outer vessel; D, a boiler for water; E, a boiler for steam; F, the lid, which of course fits the upper rim of the outer vessel as well as the boilers.

Fig. 2 is a view of the bottom of the inner vessel, showing the air-holes round the burner.

Fig. 3, the curved upper rim of the outer vessel, showing the air-holes.

By removing the boilers and placing an iron plate, the size of the inner vessel,

Fig. 1.

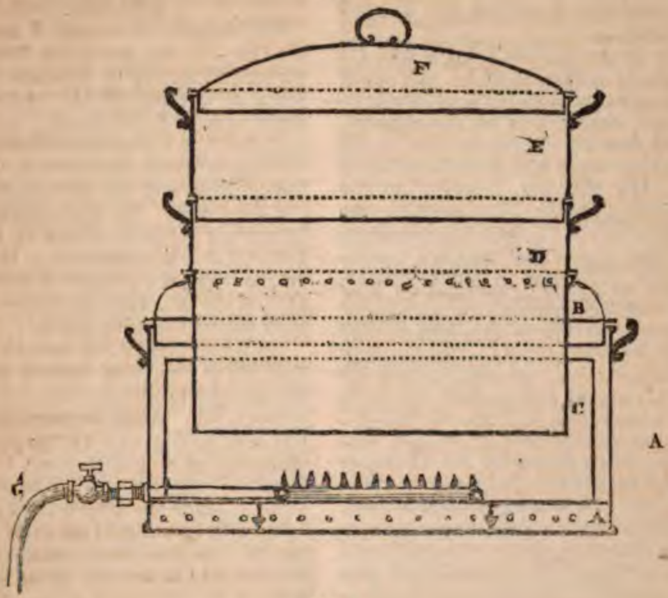
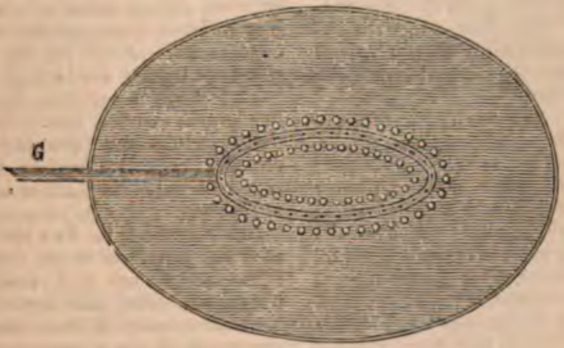
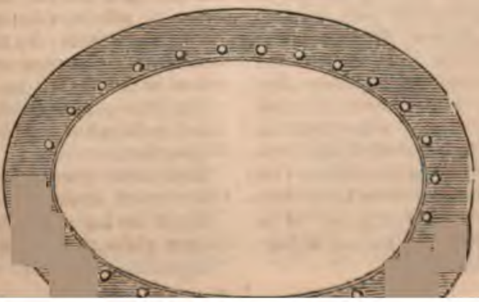


Fig. 2.



3.



and having legs three inches long, in the inner vessel, the apparatus may be used for baking.

[Our correspondent's apparatus for cooking by gas seems to us to possess considerable merit in point of compactness and convenience of arrangement, and our first impression was that it did not infringe upon Mr. Hicks's patent of 1831. On referring, however, to the specification of Mr. H.'s invention, the title of which is "certain improvements in culinary apparatus," and to a correspondence, published in our Magazine, which took place between parties interested therein and others who were alleged to have infringed upon it, we must confess ourselves to be in doubt upon the subject, (see vol. xviii, p. 296; vol. xxiii, pp. 271, 448; vol. xxiv, pp. 13, 80, 122.) By this correspondence it will be seen that Mr. Beale claims for Mr. Hicks, as included in his patent, all means of cooking by gas in which an *envelope* is used. In the specification a roasting apparatus only is described, with a "*conical* hood *suspended*" over the gas flames and meat to be cooked. The patentees appear to have thought the patent in danger by this restrictive description of the specification, and in 1837, they, under the Patent Law Amendment Act, obtained leave of the Attorney General to disclaim the words "conical" and "suspended," stating that it was "not necessary to obtain the full effect and benefit of the invention that the hood or covering should be conical, but that it may be of any shape; or that it should be suspended, but that it may be supported over the meat and gas in any convenient manner." We do not know whether the matter was ever legally set at rest—we believe not. Under these circumstances we should be inclined to think that as regards roasting and baking, our Battle correspondent's apparatus might be considered as an infrigement upon Mr. Hicks's patent—but that the arrangement for boiling would hardly be so considered. Our readers will perhaps form a judgment for themselves on referring to the pages above cited. Infringement or not, however, the apparatus appears of a very convenient and simple nature, and a knowledge of it may be useful to such manufacturers as may have obtained licenses from the proprietors of Mr. Hicks's patent; and to our friends abroad, of which we can boast of not a few.—ED. M. M.]

Experiments with the Gas-cooking Apparatus.

Sir,—Since I wrote last I have tried the Gas Cooking Apparatus with an experimental meter, to ascertain the expense of cooking by it. I have also made some additions to it. I will state the results, and shall feel obliged if you will append this article to what I wrote before, when you put my sketch, &c., in the Magazine. In my experiments I have taken the price of gas at 10s. per 1000 cubic feet, for though in most provincial towns the price is higher, yet a general use of the cooking apparatus will soon reduce the price to 10s.

1st Experiment: Put on my tea kettle with three quarts of water; boiled in half an hour; consumed five feet of gas; expense, ½d. After the water boiled, it was kept boiling with a consumption of only two feet of gas per hour, 10 feet in 5 hours; expense, 1d. I have subsequently boiled the same quantity in the kettle with four feet of gas; the water in the last case was taken from a well, in the first case it was soft water with bits of ice in it.

2nd Experiment: Put on my boiler with two gallons of water in it; boiled in ¾ of an hour; consumed ten feet of gas; expense 1d. After boiling, the water was kept boiling with a consumption of three feet of gas per hour, fifteen feet in five hours; expense, 1½d. I have found that about the same quantity of gas is required to boil a certain quantity of water, whether it is made to boil quickly or slowly.

3rd Experiment: Put on my boiler with two gallons of water, and when the water boiled, put in a beef pudding, which was boiled for three hours, and steamed potatoes in the steamer over; consumed 20 feet of gas; expense, 2d.

4th Experiment: Made a second boiler to hold six quarts, to fit on the first boiler; put on first boiler with two gallons of water in it; the second boiler with five quarts of water, over the first boiler, and the steamer on the top. The first boiler boiled, as before, with ten feet of gas, the second boiler soon made hot and kept simmering with the heat from the first boiler. With this apparatus a piece of beef might be boiled in the first boiler, in the second boiler puddings might be boiled, soup made, or many other culinary processes carried on, and vegetables steamed over, and all this

with a consumption of $3\frac{1}{2}$ feet of gas per hour, or $17\frac{1}{2}$ feet in five hours; expense, $1\frac{3}{4}$d.

5th Experiment: Made an iron plate with places in the apparatus for it to rest on, two inches above the gas burner. This plate has three rows of holes in it. Placed a stand $\frac{3}{4}$th of an inch high on the iron plate, in which was put a tin baking dish. In this we have baked a piece of beef, 7 lbs., and a small shoulder of mutton. Each piece was baked with 10 feet of gas, expense 1d., and water kept hot in a vessel over the meat, while the meat was baking, and I have no doubt but that I shall be able to bake and boil at the same time. The meat was equal to roasted meat, and was well browned, and every thing we have cooked has been done uncommonly well. My apparatus is about large enough for a family of five persons, but they may be made of any size and shape, and I have no doubt many improvements will be made in it. Conveniences for warming dishes and plates might be added, and other things required. The above experiments show that cooking with this apparatus can be done much cheaper than by coals, and when we consider its other advantages in cleanliness and facility of execution, it must come into general use. We are very well satisfied, and much pleased with its performances.

I am, Sir,
Your obedient servant
WM. WELLER.

Battle, March 10, 1840.

DIVING HELMETS AND DRESSES— DEAN'S, BETHELL'S, &c.

[From a very interesting narrative given in the *United Service Journal* of Colonel Pasley's "Operations at Spithead, with a view to the removal of the wreck of the *Royal George*."]

During the whole of these operations, but more especially at first, boats came out every fine day with spectators, to see what was going on, and especially to see the divers go down, which was an object of great curiosity. For the first fortnight, the impression on the public mind was not favourable to either of the two divers. But allowance must be made for the extraordinary depth to which they had to descend on quitting the wreck; for *even George Hall, who distinguished* himself afterwards by his extreme activity and intrepidity, commenced very cautiously at first, until he became familiarly acquainted with the state of the wreck. On one occasion his breast line, or *life line*, as it is usually termed, became entangled in such a manner, that he could not clear it by all his efforts, upon which he cut it with his knife, and came up to get a new one. On another occasion part of the pump broke, by which the men above were forcing down air into his helmet, upon which they made him the signal to come up; but without giving him line to ascend himself by his ladder, they pulled up by the line. His townsman, Hiram London commenced more brilliantly, but then he had the advantage of Hall's experience. The diving apparatus used by Hall was the property of the Ordnance, made by Mr. Sadler of No. 76, Tooley-street, according to Dean's original plan, with a water-proof dress in one piece, coming up to the diver's nose, and tied round his neck by a handkerchief, and also tightly bandaged round the wrists, to prevent water rising in the sleeves; whilst a short water-proof jacket connected with the helmet comes a little way down the breast and back, and it is by the bottom of the jacket that the foul air breathed by the diver escapes. The other which was first used by John Smith, and afterwards by Hiram London, was Mr. Bethell's patent apparatus, the construction of which was extremely ingenious. A small lantern was screwed to one side of the helmet, to burn a light under water, which both Colonel Pasley and the divers considered unnecessary, and it was never used. Indeed, the air pump could not possibly have supplied sufficient air for a man's respiration and a lamp also, unless in very shallow water; and therefore, if such a light could have been of any use, it would have been impracticable to work with it at Spithead. This patent differed from Dean's apparatus, which was of prior date, inasmuch as the whole of Mr. Bethell's dress was intended to be water tight, with a short pipe attached to the helmet, by which only, the air escaped, and not by the folds of the cloth. The dress was composed of two parts, a jacket reaching a little below, and a pair of trowsers reaching above the middle which were folded over each other, and confined by tying them close into a circular groove fitted to an iron belt passing round the man's waist. This arrangement not proving to be water tight, Mr. Bethell was applied to and immediately replaced it by sending a jacket and trowsers to be fitted together by screws and a leather collar between two thin iron belts or flanges, to one of which the helmet and jacket, and to the other the trowsers were attached. The di-

vers objected to this arrangement, as they said that it would require so much time to screw and unscrew the parts, as would add greatly to their fatigue; in consequence of which, as Colonel Pasley did not wish to dictate to them, he stated their wishes to the Admiral Superintendant of Portsmouth Dock Yard, to whose department this apparatus belonged, and it was altered by cutting off the air pipe projecting from the helmet and soldering up the hole there; and by also cutting off the lower part of the jacket attached to the helmet, and providing a high water-proof dress to be tied round the neck instead of Mr. Bethell's shorter trowsers. It was then perfectly assimilated to Mr. Dean's apparatus, in which the divers had greater confidence, though it is possible that the principle of casing a diver in a complete dress, perfectly water tight, including the helmet, and having no openings in any part, except one for the admission of the pure air from the pump, and another for the escape of the foul air, both in the helmet, may be an improvement, if they had a fair trial. But all the operative divers that we have met with, are partial to Dean's original construction, which is the simplest, and they consider it perfectly safe, unless a diver were to meet with some injury below that stunned him, in which case they think that Mr. Bethell's and Frazer's apparatus, as well as one or two more that have been proposed in preference to Dean's, on account of their alleged superior safety, would not be free from danger. As a diving helmet and dresses are too expensive to be laid aside, until rendered unserviceable by fair wear and tear, and as they have hitherto been only used by men of moderate capital, one cannot expect this point to be determined until the use of this valuable invention shall become more general than it is at present. But whatever the improvements have been, or may hereafter be made in it, there can be no doubt that Mr. Charles Dean deserves the credit of having first brought it to an efficient state, indeed we may say to considerable perfection, and of having proved to the world by his own example and exertions how very useful it may be. For it will be allowed, that whatever was suggested or done, in respect to the diving helmet, before he undertook to improve it, was either a matter of mere speculation, or of occasional experiments which were never applied to any useful practical purpose.

To conclude the comparison of Mr. Bethell's and of Mr. Sadler's diving apparatus. The air pump supplied by the former was found to be the best even after Mr. Sadler, who came out to Spithead one day from curiosity, had very liberally, and of his own accord, sent down a new one from his establishment in Tooley-street, when he found the first was not approved. The inferiority of Mr. Sadler's pump was ascribed to the peculiar construction of the pistons, which consisted of several washers or collars of leather, confined between two pieces of brass and exposed to friction on their edges. It being necessary to work the air pumps very quickly, these leathers became heated and inconveniently hard in consequence. Notwithstanding the better performance of Mr. Bethell's pump, the two divers who used his apparatus, John Smith and Hiram London, both complained of want of air, which induced Colonel Pasley to open one of his India-rubber air pipes; and though it looked sufficiently large outside, the interior aperture was found only to be a quarter of an inch in diameter, whereas, Mr. Sadler's air pipes, which were stiffened internally with spiral wires measured half an inch in clear diameter; thus affording a passage for air four times as large as the former. On this defect being discovered larger air pipes were ordered and fitted to Mr. Bethell's pump, which then gave the greatest satisfaction to the intelligent diver who used it. But both pumps required much attention, and it was even necessary at times to use the large pump belonging to the diving bell to supply the helmets with air whilst their proper small air pumps were being repaired.

WHITELAW AND STIRRAT'S PATENT WATER MILL.*

[From the *Paisley Advertiser*.]

Several months ago we called public attention to a new Water Mill made by Messrs. Whitelaw and Stirrat, by which water is applied in giving motion to machinery, in a way much more efficient and economical than by the ordinary water-wheel. At that time, one only of the mills had been erected, and it being but of three-horse power, it was not considered, generally, as affording a sufficient test of the value of the principle it involved. Since then, however, one of them has been put up at Midton, near Howwood, of twenty-horse power, and the effective power previously tried with a mill of three-horse power, has been fully tested with one of twenty.

We had the pleasure this week of witnessing the above mill in operation, and of conversing on its properties with Mr. Allan, the gentleman whose cotton-spinning machinery it drives, and shall state shortly how he has found it to operate.

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* See Mec. Mag., vol. xxxi, pp. 77, 416.

Mr. Allan has a fall of 28 feet, and the command of fully 300 cubic feet of water per minute. The diameter of the water-wheel, an overshot one, heretofore in use, was 21 feet. This wheel, with a full supply of water, was barely able to drive the machinery; indeed one part of it could not be driven with it at all, and lay past in the factory as an incumbrance. The present water-mill, with less than one-half of its power applied, is found amply sufficient to drive the machinery, the part that has heretofore been allowed to lie idle for want of power, is about to be brought into use; and it is not anticipated that, even with this addition, much more than one half of the power will be required. The points of most importance connected with this new mill, as compared with the old water-wheel, are, *first*, dimished cost of first erection; *second*, greater convenience in point of space occupied; *third*, simplicity of construction occasioning less risk of getting out of repair, and consequently less expense in upholding; *fourth*, a much greater effect produced by the same height of fall and quantity of water; *fifth*, its superior powers in adapting itself to a varying supply of water, and a varying extent of work; and, *sixth*, its applicability in many cases where ordinary water-wheels could not with any profit be applied. We shall say a few words on each of these points.

1. With respect to the cost of first erection. On this point we are assured that, had a new water-wheel been erected in the instance to which we are now adverting, the cost of the wheel and arc would have been about 500*l*., whereas, the cost of the water-mill will scarcely amount to the half of that sum. In a case where one of them is about to be applied on the Shaws water, Greenock, the wheel and arc would have cost 1,400*l*., while a water-mill of similar power, will probably, not much exceed 400*l*. We may observe, that the greater the diameter of the water-wheel, the greater is the proportionate difference between the cost of it, and the water-mill of equal power.

2. Greater convenience in point of space occupied. In this the advantage is fully as marked as in the cost of first erection. Every one who has seen a water-wheel in motion, must be aware of the great space occupied, and the inconvenience thence arising, especially where boundaries are limited. In the case of the water-mill, it may almost be said, that no space is lost. A circular pit, a few feet more in diameter than the extended arms of the mill, is all the space occupied, and it may in certain circumstances be below the level of the floor, leaving nothing whatever in sight but the revolving shaft projecting *upwards from the pit*. This pit can either be at the middle or at the end of a building, to suit circumstances. The shaft will thus extend upwards through every flat of a factory, and the power required for each flat, will be taken directly from itself.

3. Simplicity of construction is also a great recommendation to the mill. In looking at it in the pit, little more is seen than an upright revolving shaft, with three curved horizontal arms at the bottom. From the extremities of these arms, the water comes, not rushing, but gently out; falls into the circular pit, and runs off by a suitable channel. The whole of the materials are of metal; the quantity of it is not great; all its parts are exceedingly compact; and in the circular pit in which it revolves it is completely protected from all external injury.

4. Much greater power is obtained by this mill, than by the ordinary water-wheel. Generally speaking, water-wheels, even of the best construction, do not give above 66 per cent. of the motive power of the water; many of them not above 60 per cent.: whereas the power really obtained from these mills amounts to about 90 per cent. One principal cause of this, is avoidance of friction, which by various ingenious and simple contrivances, is almost wholly got quit off.

5. The power which the mill possesses, by a self-acting governor, in regulating its speed to the work to be performed, is an admirable feature in it. One part of Mr. Allan's machinery requiring about three-horse power to drive it, has to be thrown off occasionally. With his old wheel, which had no governor, he had to go out and lower the sluice before this part could be thrown off; otherwise the remainder of the machinery would have been driven with such violence as greatly to endanger it. With the present mill the additional machinery is thrown in or out of gearing with no perceptible variation in velocity. Well constructed water-wheels are furnished with governors calculated to diminish the orifice of the supply aperture, and thereby adjust the velocity to the work required; but the object is gained in the water-mills by an ingenious contrivance, much more speedy and effective. The mill we are now speaking of has three arms, and is, as we have said, about 20-horse power. One of these arms by a simple operation may be closed up, and two left at work producing two-thirds of the whole power. Two may be closed up, and one only left in operation, which will produce one-third of the power. Thus the mill can be adapted with the greatest ease and speed, to the quantity of water obtainable; while, whether one arm, or two, or three be employed, the governor for regulating the speed, which we may observe is about 112 revolutions per minute, prevents its going

beyond that speed, whatever quantity of the machinery may be detached.

6. The last valuable property of the water-mill, we shall at present notice, is its applicability to cases where the ordinary water-wheel can be of no use. These cases are where the stream of water is small; but the fall great. Such places on hill sides by banks of rivulets are numerous in almost every country. In such places no use is got of the falls, because they would require a wheel of a diameter altegether impracticable for use; but mills of this kind may be erected to secure the whole benefit of the fall, however great. We may farther notice that one of these small mills of three-horse power was lately fitted up on a fall of only 10 feet, in the vicinity of Barhead for the purpose of driving a thrashing-mill, and answers the purpose admirably. For thrashing, indeed, and churning, they will in all likelihood soon come into very general operation.

Whether in the upward range of power any limit may be assignable, beyond which the benefits of such mills cannot be obtained, we cannot say, but in the increase from the first trial of three-horse power to one of twenty, no symptoms of failure have been observable in the principle, that in all circumstances the power of the mill will be in accordance with the weight of the column of water in motion. Ere long the principle will be tried to a still greater extent, as the patentees are fitting up two mills on the Shaws Water at Greenock, one of which will be about 60-horse power.

As in the case of almost every other invention or discovery, the benefits of this invention have been generally met with scepticism. When Mr. Allan required to renew his water-wheel, he consulted with a number of skilful persons as to the propriety of venturing on such a mill, but their advices were uniformly dissuasive. He consulted several engineers, but, they, too, gave him no hope. On the contrary, he was told by some of them that the water might set the mill in motion, but assuredly the mill would never drive the machinery. Against all this he had nothing but the ocular and practical demonstration of the mill recently erected at Mr. Stirrat's field.

He was guided by observation, gave an order, and now finding the benefits greater than he anticipated, he naturally congratulates himself on having followed what he saw in practice, rather than listened to speculative opinion. His satisfaction certainly rests on very good grounds; seeing that if he had ordered a new wheel of the common construction, its powers would have been taxed nearly to the full, to perform the required work, while its cost would have been about 500*l.*; whereas by the new mill his machinery is easily driven; about a half of its power is in reserve for future emergencies, while the cost does not amount to a half of the above sum. In addition to this, expense for repairs, will to all appearance be much diminished, while the period of renewal bids equally fair to be greatly prolonged.

The confidence of the inventors may be judged of from the fact of their having taken out patents, not merely for Scotland, Ireland, and England, which last includes our colonial dominions; but also for the principal states of the Continent.

Believing that this new mill will effect a revolution in hydraulic power, second, perhaps, in importance, only to the improvement of Watt in the application of the powers of steam, we have much pleasure in lending our humble efforts in assisting to make it more generally known. To all who are about to avail themselves of water power, applied to give motion to machinery, we would recommend a consideration of these new mills. We would not say to them, by all means erect such mills; but we would say, before you erect a cumbrous and expensive water-wheel, do as Mr. Alian did, look at the water-mills in operation; see what they can do, or at least what they are really doing; and then be guided by your owu judgment. We may observe that the most distant of the three mills adverted to, is within an hour's ride of Paisley.

HAGUE'S PATENT PNEUMATIC MACHINERY FOR MINING PURPOSES.

Among the many varieties of machinery which have been of late years applied to mining operations, that of working by pneumatic principles (from the success which has attended its application) appears to us as deserving of notice, inasmuch that the certainty and regularity of its movements, and its freedom from stoppages, attendant on other machinery, is altogether, or nearly so, avoided. Without remarking upon the general benefit derived from the adoption of pneumatic machinery, we purpose simply to call attention to the operation of the machinery, which has been patented by Mr. John Hague. Of the advantages derived from its introduction, we may observe, with respect to its use as a means of raising water, the description which has been given by Dr. Birkbeck, who has examined and reported on it in a highly favourable manner, and whose report conveys a very clear notion of the apparatus employed for that purpose.

"The principle," Dr. B. observes, "upon which Mr. Hague has proceeded is unquestionable, and the means adopted for its

application are simple and effective. He removes the air from an air chamber, pipes, and connected vessels, by an air-pump; and by suction pipes, as they are commonly termed, so combined as to elevate the water by successive lifts, is enabled to empty, without increased difficulty, mines of the greatest depths. The motion of a four-way cock, required for alternate connection with the vacuum, and with the sources of the fluid to be withdrawn, is effected by mechanism of the most simple kind; and as each lift has the cock moved without any connection with the others, the number of lifts requires no additional strength or complexity as to the means employed."

From a consideration of the manner in which a column of water can be thus raised, viz., from the circumstance of the perpendicular height only being to be taken into the account in elevating the fluid from one cistern to another, it is clear that an inclined plane, no matter how great the inclination, may, without increased difficulty, be made as available for drainage as a perpendicular shaft. This, of itself, to those who know and suffer from the immense expense attendant on the wear and tear that now results from working a common pump on an inclined plane, cannot fail to force attention as an effectual remedy. Another, and not an inconsiderable advantage is, that of securing the passage of a column of water, almost without friction, from the extremity of any workings, round any corners, and along the most tortuous windings—thus enabling workings to be carried continuously on the vein or seam, instead of expending so much labour in the unproductive rock. It may also be said, that every removal of portions of air through the cisterns and air-pipes, will improve the ventilation; and it may be made a matter of an easy calculation, to fix the absolute quantity of foul air, where such exists, that would be withdrawn, and an equal amount of pure atmosphere introduced.

The application of pneumatic power, we may further remark, is not limited to draining purposes, but may be applied to working whimseys, mills, or any other machinery, at almost any distance, the power being conveyed from a water-wheel, steam-engine, or any other motive-power, simply by means of an air-pipe connected with an air-pump; and, by the exhaustion thus produced in a cylinder, fixed at the point to which the power is conveyed, a motion is given to a piston, which is thus worked by air instead of steam. The friction caused by this is small in amount, and the transfer of power at any angle, winding, height, depth, or *distance*, is most *complete*.

These advantages are not imaginary, as at Lowside Colliery, at Oldham, in Lancashire, by means of a 12-horse engine, the power is transferred down a perpendicular shaft of 120 yards; and, further, a considerable horizontal distance, from which the deeper workings are drained to the extent of 200 gallons a minute, on an inclined plane of 240 yards long, at the same time working a pneumatic whimsey, for drawing coals up a similar inclination. The like advantages are obtained in other places, in addition to a superior ventilation being obtained.

The present notice is too brief to enter into detail, but we purpose returning to the subject, and, if practicable, furnish a plate, which may better explain the process than any observation of ours; in the mean time we may observe, that this machinery is equally applicable for drainage, or raising water, as well as to mining, and for the transfer of power in manufacturing or other purposes. We may add, that this has been so far effected, as to procure for its inventor a high mark of distinction from the Turkish Government, from the erection of powder-mills, which are worked at a distance of three-fourths of a mile from the motive-power. It has also been employed for working the Mint, at Rio de Janeiro and at Utrecht.—*Mining Journal*.

NAVAL IMPROVEMENTS AND WORKS — ARTIFICIAL FUEL FOR STEAM-ENGINES.

On bringing forward the Navy Estimates for the year, the following statement was made:—"The next head of expenditure, the 11th, for new works and improvements, as one of considerable importance to the efficiency of the navy. The excess this year, under that head, was 33,000*l*. The Board of Admiralty had determined to ask the house to assent to that increase to be applied mainly to new works. Great improvements were made last year at Deptford, by the establishment of a rope manufactory; this year it was proposed to establish machinery there for the spinning of hemp. These improvements when completed would effect a saving to the public of 70 per cent. At Woolwich, as the house was aware, considerable works had been carrying on for a long period. A new masthouse, a storehouse for steam machinery, and manufactories, had been erected at a cost of about 23,000*l*. It had also been thought proper to erect a building of machinery for making fuel on the plan of Mr. Grant, a gentleman who had been some time in public employ, and who had contrived a composition of coal-dust and coal-tar, which was found to have

a strength of about 40 per cent. over coal, being about one-half more efficient than Newcastle coal, and one-fifth better than Welsh coal. It consequently, when used, kept a steamer much longer at sea. In addition to this 1,500*l.* had been applied for the erection of a store-shed at Sheerness. In former years 3,000*l.* had been expended in cleaning out the harbour there; this by means of a new process which had been adopted would in future, he hoped, be wholly, or in great part, saved to the country. At Portsmouth it was proposed to have additional saw machinery. There was also another addition. At Pembroke it had been proposed to erect new slips for the building of first-rates, and accordingly the erection of four new slips had been resolved upon." In reference to the statement made upon the subject of Mr. Grant's composition fuel, a letter has been published in the daily papers from a Mr. Oram the patentee of an article of this nature, (the specification of which was published in our 30th vol. p. 365,) stating that Mr. Grant had applied for a patent, and that he had opposed the application, and that the At orney General had refused to report to the Crown in favour of the patent to Mr. Grant. The matter, however, remains for further consideration. We believe that Mr. Grant has been for some years experimenting upon the subject, and that the delay which took place in applying for a patent arose from Government refusing at first to allow him so to do, upon the ground that as he experimented at public expense, the result should be for the public benefit.

NOTES AND NOTICES.

Mr. Oldham, the late Engineer to the Bank, The *Courier* states that this gentleman was in his 61st year. Until his invention for checking the number of notes printed, and for preventing forgery, was adopted by the Bank of England, they had no positive means of effectually stopping the latter, or of telling the number of notes struck off by their printing presses. Mr. Oldham was in possession of a large salary, with the right of reversion of a portion of it to his son.

Iron Pyrites and Calamine.—This mineral, which is composed chiefly of iron and sulphur, and is produced in considerable quantities from some of the Derbyshire lead mines, promises, in consequence of the high price of sulphur, to be in some request. It has hitherto been considered as *deads* or rubbish, and has been thrown away as such. Some gentlemen have been making inquiries for the article (known here as brazil or mundic) at Matlock, and twenty tons have been forwarded to their works, selected from the old hillocks of the Oxclose mine, at Snitterton, and the company express themselves willing to take any quantity that can be collected. Inquiries have also this week been made after calamine (*lapis calaminaris*) and arrangements are in progress which may probably lead to a market being again opened for this once important article to the miner. Calamine is abundant in the neighbourhood of Bonsall and Matlock, and as much as three thousand pounds annually have been paid for the article in Bonsall alone; but, owing to the introduction of a foreign article, the price has of late years so much declined as to make it (except in a very few instances) no longer worth working for.—*Derbyshire Courier.*

Parallel Motion in Steam Engines.—Among the many mechanical inventions produced by the fertile genius of Watt, there is none which has excited such universal, such unqualified, and such merited admiration as that of the parallel motion. It is, indeed, impossible even for an eye unaccustomed to view mechanical combinations to behold the beam of a steam-engine moving the piston through the instrumentality of a parallel motion, without an instinctive feeling of pleasure at the unexpected fulfilment of an end by means having so little apparent connection with it. When this feeling was expressed to Watt himself by those who first beheld the performance of this exquisite mechanism, he exclaimed, with his usual vivacity, that he himself, when he first beheld his own contrivance in action, was affected by the same sense of pleasure and surprise at its regularity and precision. He said that he received from it the same species of enjoyment that usually accompanies the first view of the successful invention of another person.—*Dr. Lardner on the Steam Engine.*

Launch of an Iron War Steamer.—On Thursday, February 6th, was launched from Messrs. Ditchburn and Mare's building yard, Blackwall, the *Proserpine*, wrought-iron steam-vessel of 470 tons. She has four sliding keels, nine water-tight bulkheads, two of which are longitudinal running the entire length of the engine-room—is armed with four long guns on non-recoil carriages, and will not exceed four feet draught of water when fully equipt for sea. The engines are two 45 horse, having the wheels to disconnect on a new and improved method to facilitate sailing, by Messrs. Maudsley, Son, and Field. This vessel is constructed for sailing as well as steaming. It is a fact worthy of record, and ought to be generally known, that Messrs. Ditchburn and Mare were the first who arrived at the hitherto deemed unattainable result of giving highly superior sailing qualities to iron sea-going vessels of shallow draught of water. Their application and improvement of *sliding keels* have been most successful, their simplicity is such that a boy can manage them. Every person conversant with the history of naval architecture is aware that Captain Shanks, R.N. was the ingenious inventor, and that he received his first idea of them from the Indian navigating his raft; but although Capt. Shanks, was aided by the government of his day, and made several attempts to establish their use in timber-built vessels, he failed, chiefly in consequence of the great difficulty in making the well and aperture through the keel, through which the sliding keel works, permanently water-tight; this in an iron vessel can be most perfectly accomplished. They are of the highest utility in the prevention of lee-way, counteracting rolling motion, and the vessel can be steered by them without the help of the rudder.

Testing the Strength of Iron Boats.—On Monday, February 24th, as they were lifting from the wharf a 25 horse boiler of an iron boat, built by Ditchburn and Mare, the crane which was of cast-iron broke, when the boiler and crane fell a distance of eight feet into the bottom of the vessel, little or no damage was done, and fortunately no one was hurt. This vessel is named the *Lee*, and has the reefing wheels after Mr. Hall's patent, we believe this to be the first application of them—we wish them every success.—*Civ. E. and Arch. Journal.*

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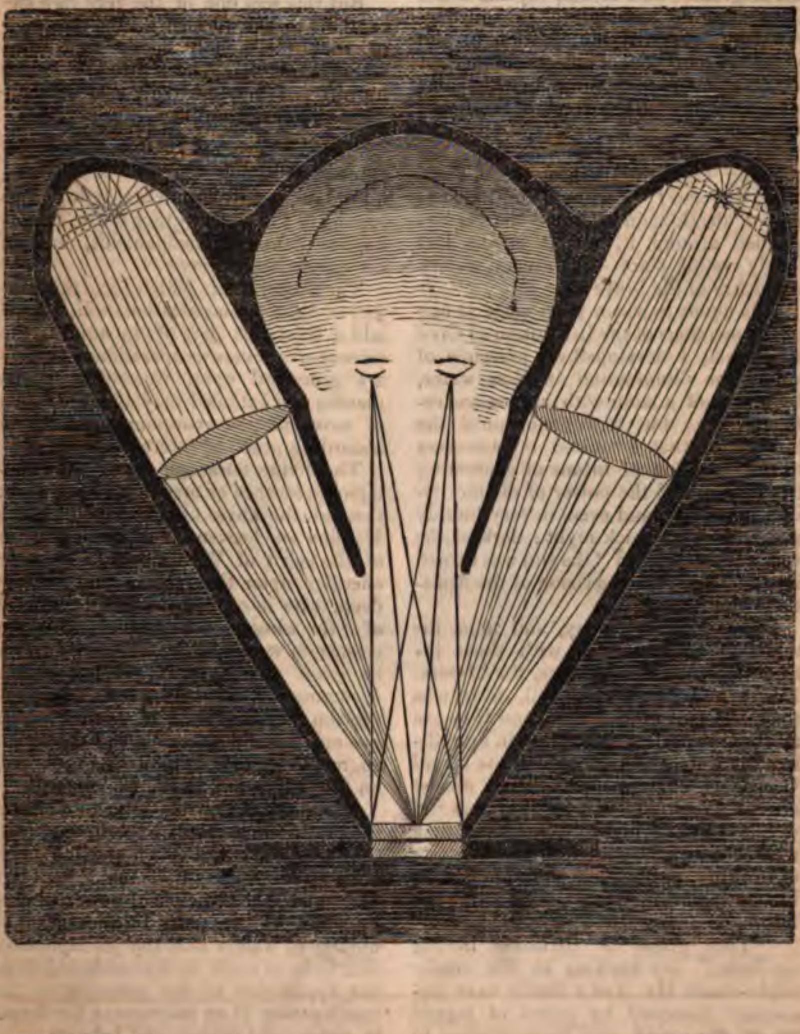
STEELE'S SUBMARINE FOCAL ILLUMINATOR.



STEELE'S SUBMARINE FOCAL ILLUMINATOR.

——— Holy Light! ———
—————————————
The ——————— waters dark and deep,
—————————————
——————————— illume, ———

Extracts from Milton's Address to Light.
Paradise Lost.

Magdalene College, Cambridge,
March, 1840.

My dear Sir,—I have carefully drawn the diagrams which accompany this letter, illustrating my *principle* of subaqueous, inwardly generated illumination of the parts in succession, of objects submerged in dark waters like those in which lies sunk at Spithead, the wreck of the *Royal George.*

That majestic vessel was once the roaming, Lightning-flashing Ocean Fortalice, but alas! "darkness and the shadow of death stain it" now—the sea has yawned around it, and it is the last lonely resting place,—the dreary, watery sepulchre of the brave!

It is about fourteen years since at one of the meetings of the Institution of Civil Engineers, I developed my principle of submarine illumination in *clear* water, by means of a lamp with a concave reflector, &c., but it was not until the last winter that I turned my attention to the invention of means of generating irradiation, and the power of distinct vision in muddy, and even in very muddy water, dark as thick night; dark as the very sun itself when "the sun was turned into darkness," in the vision of the Apostle in the Apocalypse.

I have had very many, and most interesting conversations with those intrepid and admirable divers, the Messrs. Deane and Mr. Peter Tall, who was their assistant at Spithead, and they are all three in perfect accordance in describing the waters there in which the *Royal George* is engulphed, as being *almost always* so muddy and murky that the wreck is utterly invisible, and that they were consequently under the necessity of working, not by their sight and touch, but by their touch only,—viz: like the blind.

"They grope in darkness having no light." By working in this deadly night-shade Mr. Tall's hands were frequently lacerated by pieces of jagged iron of the wreck, and he mentioned to me last December in Liverpool, where he now resides, that only once out of seventeen times when he was down upon the wreck, had he a glimmering of light giving even a dim vision.

On one splendidly bright day, and when it happened that the water was much less muddy than usual, there was a faint pale shimmering lurid twilight around, and on the wreck, and he saw a human skeleton of which when he next ascended the ladder, he brought up one of the thigh bones.

But this was one of the very rare exceptions to the forlorn dismal darkness of that melancholy flood,—and even when lamps have been brought down burning, it may be truly said of their wan, and evanishing flames—

——————— "Yet from these flames
No light, but rather darkness visible!"

a kind of ghastly sepulchral light, glimmering in the watery grave of the gallant hapless Admiral Kempenfeldt, and of his gallant hapless crew.

The observations which form the subject of this communication, will, I hope add a fractional part of an atom to the science of submarine operations; as they are grounded upon diversified experiments; and I think I may add, on habits of most cautious contemplation before hazarding practical inference.

The divine telescope draws the intelligential essence of man in roaming flight through the abyss of celestial space, the Hyaline of heaven; and the effluence of the spirit of Watt moving with fiery energies upon the face of the billowy deep, tears in conflict the awful plumage of "the wings of the wind." But, the science of works to be effected *beneath* its great waters, is as yet but as the dreaming of a slumbering infant, in comparison with the state of science which has created the telescope and the steam engine, those twin annihilators of space, on this globe, and in the firmament!

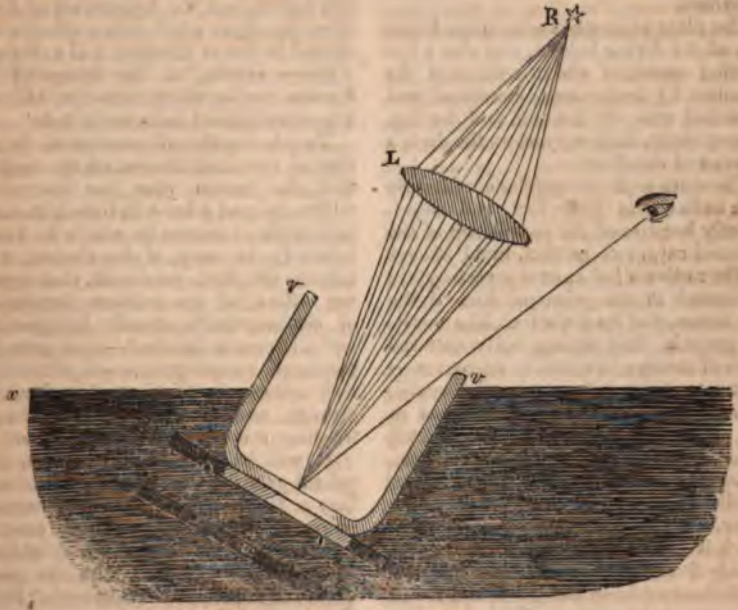
From the following simple diagram illustrating one of my experiments (*viz.* that made at the bottom of Kingstown harbour on the night of the 31st of last December) the principle of powerful illumination of the parts in succession of objects in waters like that of Spithead, will be most easily understood, and then, the application of the principle to the construction of an instrument for divers in water-tight dresses and helmets.

Suppose R to be a radiant, for example, a brilliant lamp, or the oxyhydrogen gas light. L, a double convex lens; *v v*, a vessel with a glass bottom with parallel surfaces, and in water artificially and deeply darkened by an intermingling of wet trampled coal dust with common mud.

The white object under the bottom and *in actual contact* with it, is the *Morning Chronicle* with my letter, in which I first propounded my theory.

Now that letter would be utterly invisible, no matter how powerful the light in the focus at an exceedingly small distance from the bottom of the vessel, in the line for example *x x*; but by being brought into actual contact with it in the waters, it becomes suddenly illuminated, and in the focus of the lens will be instantly formed on it (the lens and light being properly adjusted) *a focal image* of the radiant, beaming on the eye!

The reason of this will be made most easily obvious. The indefinitely minute particles of terrestrial matter held in solution in that infinitesimally thin plate



of water between the glass bottom of the vessel and the object, *viz.*, only the water which wets them in their contact, will not sensibly obstruct, or infect with darkness, the light glinted, and gleaming from the object, through water, glass, and air, to the eye of the observer.

When Lord Byron's Manfred commands the spirits of air, ocean, earth, and fire, and of his star, to show themselves to him "in their accustomed forms," they reply—

"We have no forms beyond the Elements
"Of which we are the Mind and Principle,
"But choose a *form, in that* we will appear."

And such are the rays of light. Like the spirits they have no forms, beyond the elements of which they are the principle; "*but choose a form!*" and when evoked by the magic spell of scientific optical calculation they will take it. They will from their ethereal elements create in the focus of a reflector or of a lens, a lucid image of any "form" placed in a proper position, determined by calculation,–in that "*Form*" they "*will appear!*"

The experiment just described was made in the diving-bell,—but the question is now, how to make the principle available to the use of divers walking,

and working "in that obscure sojourn," the darksome bosom of the briny deep, in their water-tight dresses and diving-helmets.

Omitting, for the present, practical details, however important, the following is *in a general form*, the application of *the principle;* and the construction of the instrument, follows directly from the experiment just described. Let us suppose the diver to be in his drear abode on the bottom, and either standing or walking in the thick darkness, in the "gloom and the day of blackness," of water like that which, on the evidence of the Messrs. Deane and Mr. Peter Tall, I have already described.

The plate represents a horizontal section of the diving helmet, and also a horizontal section of the two wings of the illuminating instrument, combined and identified with the helmet, and having, consequently, their support on the diver's breast and shoulders.

There are to be two parabolic reflectors with radiants in their foci, and consequently because of the parallelism of the reflected rays, two perfect, lucid images of the radiants (of course inverted) will be formed in the principal foci of the two lenses, and let these foci, like dazzling gems in their setting, fall within the piece of strong glass, and in its centre,—strong, and also to be as clear as crystal, with parallel surfaces as represented in the plate, and which is to be inserted perfectly water-tight in the instrument.

Let now some substance, for example, the diver's own hand, or a piece of white paper, or the bottom of a leaky ship, which it is necessary to examine in the muddy fluid, be placed at an extremely small distance from this glass, and it will be as utterly invisible as if the thin plate of interposed water, were a massive plate of iron, or vessel of mercury.

But, let the diver draw his hand, or the paper *into contact* with it; or if we take the bottom of the leaky ship as the illustration, let him approach it and place the glass in contact with it, and in this, or any case whatever, the moment *actual contact* is created, that moment a focal image of the lucid flame *must burst* upon his vision, playing upon his hand, or upon the paper, or the bottom of the ship; *viz.* the focal images of the radiants which *are burning* in the foci of the paraboloids, *accurately taking* their "*form*," and also *accurately* coloured by the effect of the talismanic spell of the two double convex lenses.

It will not be actual flame, it will not be the Hrympther of the Scandinavian Edda, the spirit of fire; but the paper, or wood, or copper of the ship, or the hand, &c., as it may happen to be, will not merely appear illumined, however muddy and midnight-gloomy the water, but it will *appear to be*

"Clothed with flames and amber light,"

it will not be actual fire, but it will be

"Full many a fathom deep,"

in the dreary flood, like that which was seen by Ezekiel in his vision, "a light like amber, and the *appearance of fire*," upon the object which was a quarter of a second before as viewless, and as little of "things visible," as the beings of the human species whom ages ago, eternity has overwhelmed in its awful tide!

To take another illustration of the nature of this illumination, let me suppose that the person who has descended, wishes to read a book in the night-shade tabernacle of waters by which he is enveloped; he may, if he choose, read adown the dark profound, that appalling effort of the creative inspiration of Shakespeare's omnific imagination, —"Clarence's Dream,"—that pure intensity of human pathos—of *picturesque and solemn description of sub-marine scenery*, and of wild, ghastly, heart-freezing preternatural dreary horror!

It will be evident at a glance, (the primal principle being thus explained,) that a third branch of the instrument might be placed on the helmet, cresting it with light, and that even a third focal image might be projected on the glass. To use an expression in Spenser's "Fairie Queene," "*skruging*" the rays of light, in dazzling condensation together, to add a deeper intensity to the focal irradiation. This irradiation it is quite manifest may be pased over the parts in succession, of objects in the water, of the nature and circumstances of which it may be necessary to have an accurate knowledge. Even the telescope, the telescope itself, with its gorgeous power, must work by a similar process of successive application; no telescope can grasp at once into its field of view, a hemisphere of the empyrean.

For the present I limit my *practical* observations to this, that the glass must be kept constantly wiped by the diver,

for there is a great difference between the effect of the atoms in solution in the wetting water, and any deposit on the glass, of these atoms in accumulation.

In the plate, the *Focal Radiance*, surrounded by illumination through the whole glass, is supposed to fall on a plank of a leaking vessel, which it is necessary to examine.

Omitting very many other things, I limit myself to the two following observations on *scientific* theory. It is evident that the heterogeneous light might, by the application of a prism, be separated into its component parts, and that prismatic colours might be exhibited on the paper in the water; and also secondly, that a case is evidently possible, in which the foci might be of *real flame*. I am familiarized with descending into the watery deep in summer's noontide and wintry night; but my most interesting meditation, or dreamy vision, or reverie, on these subjects, was one day when I descended in the diving-helmet and water-tight dress, sometimes viewing the rocks and sea-plants at the bottom, and sometimes gazing upwards through the crystalline Atlantic ocean, near the wild and caverned, stupendous billow torn cliffs of my native Clare, while the summer sun was gleaming down upon me in meridian effulgence through the water. It was the very sanctuary of meditation.

There is a deeply solemn, mystic interest, in scientific meditation on subjects like these of which I am treating, when the soul holds its communion with itself, beneath the waters of the ocean—the mirror of God!

Thou glorious mirror where the Almighty's form
Glasses itself in tempests; in all time,
Calm or convulsed in breeze, or gale, or storm,
Icing the pole, or in the torrid clime
Dark heaving; boundless, endless, and sublime—
The image of eternity—the throne
Of the Invisible; even from out thy slime
The monsters of the deep are made; each zone
Obeys thee; thou goest forth, dread, fathomless, alone.

I have the honour to be,
My dear Sir, your most sincere friend,
THOMAS STEELE,
Inventor of the Communicating Diving Bell.

MR. SAMUEL HALL'S REEFING PADDLES.

Sir,—As I almost daily meet with parties who, from not understanding the scientific principles upon which results of the highest importance are derived from reefing the paddle-wheels of steam-vessels, and who, consequently, deny the *extent* of the advantages which I contend will be obtained by my patent reefing wheels, I feel it a duty that I owe to myself, as well as to the public, to give my opinion, as below, of the relative efficient power of steam-engines, according to the speed at which they are working; such being the question at issue, and upon which some of the extraordinary advantages of my reefing wheels in a great measure depend. I give my opinion without fear of contradiction, as I imagine that there are but few persons who will venture *publicly* to deny positive facts, however they may indulge in speculative opinions (to use the mildest term) *privately*. As the iron steam barge, to which my reefing wheels are applying, will, within a week from this time, be in activity on the Thames, my statements will be confirmed or be proved to be incorrect before your Magazine for next week goes to the press, and had the slightest doubt remained upon my mind, I should have had the prudence to delay till then giving the present publicity to an opinion upon a subject which I contend is so simple that any competent mechanic will be surprised that it should become a matter of discussion, and so simple that it would be a disgrace to the merest tyro in mechanics not to understand it. If such be the case, I would ask, what value can attach to the opinion of those persons who cannot comprehend that this mode of extracting from engines the full power for which they were constructed (instead of losing one-half or two-thirds of it, as the case may be) will form, simple as it seems, a new and important era in steam navigation.

I am, Sir,
Your most obedient servant,
SAMUEL HALL.

Basford, near Nottingham, March 17, 1840.

I, Samuel Hall, consider it to be an indisputable fact that all the strokes performed by a steam-engine are co-equal in power, the pressure of the steam on one side of the piston, and the state of the vacuum on the other side being assumed to be always the same.

Thus for instance every stroke of an engine of 120 horse power calculated to make 24 strokes per minute is equal to 5 horse, consequently, if from the deep immersion of a vessel containing such engine, or from other causes, its number of strokes be reduced one-half, or to 12 strokes per minute, it will be performing only 60 horse, or one-half of its power, if the number of strokes be reduced to 8 it will be doing the duty of only 40 horse, or one-third of its power and so in proportion to the reduced number of strokes of the engine, will its power be diminished.

SOLUTIONS OF ASTRONOMICAL QUESTIONS.

Sir,—I have not had an opportunity of seeing any of the numbers of the Magazine for this last month; yesterday I happened to see No. 864, in which I find that "Nautilus" has given another solution of Iver Mc Iver's astronomical question, which seems to afford him much satisfaction; whether the scientific readers of the *Mechanics' Magazine* will be much edified by his last performance I very much doubt. The *equation* from which he deduces the polar angle Z P S (see No. 858) is tan. $x =$ tan. L. cot. L′. cosec. A — cot. A, where L and L′ are the latitudes of the two places, and A their difference of longitude. Now this *equation* (in its present state) is not at all adapted for logarithmic computation, on that account "Nautilus" has been compelled to call to his aid no less than three different sets of tables, viz., log., sines, tangents, &c.; log. of numbers; and natural sines, tangents, &c. Now this mode of calculation ought to be avoided as much as possible, for the chief art in this highly useful branch of science, is to endeavour to adapt the rules, theorems, or final equations, to answer the logarithmic calculation (and this is what "Nautilus" has not done); in support of this statement I might refer to an opinion given by "Nautilus" himself in the *Mechanics' Magazine* about two years ago. But it may be asked can the equation tan. $x =$ tan. L. cot. L′. cosec. A — cot. A, be so transformed as to answer to log. calculation. I answer, yes; and easily too.

The following solution is shorter, and perhaps better, than my first.

Using the same notation as in my first solution, and expressing the difference of longitude (2 A) in time.

(L + L′) =	107°	26′	2″	cosec.	0.020428 ..	L′=51° 28′ 39″ cot. 9.900955
(L — L′) =	4	28	4	sin.	8.892605	
	H.	M.	S.			
A............	0	6	22	cot.	1.556387	
x............	4	45	2	tan.	10.469415	
A. T. Greenwich	4	51	24	A.M.	cosin...	9.469698
						Dec. 13 12 40 N tan. 9.370653

The above method of finding the polar angle Z P S shows at once the advantages obtained by assuming Z P S $= x$ — A and Z′ P S $= x +$ A, over that of x and $x +$ A′. Where A′ in the latter notation is equal to 2 A in the former.

I shall not at present give a demonstration of the above solution; I will, however, be glad if any of your scientific contributors will do so, for indeed, Mr. Editor, I consider a solution on a subject of this kind without a demonstration, as insipid as an egg without salt.

I am, Sir,

Yours, &c.,

GEORGE SCOTT.

February 13, 1840.

EXPERIMENTS WITH HALL'S HYDRAULIC BELT.

Sir,—Hall's hydraulic belt having lately elicited some degree of interest, and as many of your readers may feel anxious to learn something of its capabilities and how far it may compete with the common mode of raising water by the pump,

both as regards economy and power, I beg to subjoin the results of two trials I lately witnessed in Portman Market. The particulars of which I carefully noted at the time; as also a general comparison with the supposed work of a pump similarly circumstanced.

1*st Trial.*—From an average depth of 130 feet, with a 7 inch woollen band, the quantity of water discharged in $11\frac{3}{4}$ minutes into the cistern was $85\frac{1}{2}$ cubic feet, or $7\frac{1}{5}$th cubic feet per minute, equal to about 45 gallons.

2*nd Trial.*—From the same depth and with the same band, the quantity of water discharged into the cistern in six minutes was about 49.44 cubic feet, or 8.24 feet per minute, about $51\frac{1}{4}$ gallons per minute.

The increase of effect in the second trial must be attributed to the engine being allowed to get into full play before commencing to check its work, and also to the additional pressure of steam in this instance (5 lbs. per square inch), consequently, additional velocity of band—although it will be observed, that the work did not follow precisely in an equal ratio.

It has been found that the most effective velocity for the band is about 1,000 *feet per minute*, and that for every additional inch in the breadth of the band, there are from seven to eight gallons gained per minute. It would perhaps be advisable to determine also the best degree of immersion for the *lower drum*, which could easily be effected, by observing during one of the trials (since the height of water in the well is variable) the period of the greatest discharge.

If we take the 2nd experiment to be the average work of the band under the most favourable circumstances, and compare it with the work of a pump in good condition worked by the same power,* accordingly to the formula given by Tredgold, we shall find the effect by the band to be about $73\frac{5}{8}$ per. cent of the power, while that of the pump is only $53\frac{1}{2}$, giving a superiority to the former of about $20\frac{1}{4}$ per cent. Certainly a vast advantage, but not equal to what was represented, viz.: that the effect by the band was 87 per cent. of the power. But it should be borne in mind that this comparison is made for a lift of 130 feet; where the friction and weight of the pump rods necessarily absorb a great proportion of the power of the engine; at lesser depths, the results would be more equalized. Thus, at a 20 feet lift, making use of the same rule, the effect of the same power pumping would be $36\frac{1}{3}$ cubic feet per minute, or 226 gallons, equivalent from the above data to the work of a 31 inch band. The question then is, whether to raise a column of water of this breadth would require an additional velocity of band? Under any circumstance, additional power, even supposing the substitution of several small bands. If so, the efficiency of the machine *diminished with the diminished lift*, a law directly opposed to that of the action of the pump, and one, if established to any extent strongly militating against the economy of its use at *short depths*. Moreover, it should be observed, in calculating the power of the engine I have used the formula of Tredgold, where nearly $\frac{2}{3}$rds is allowed for waste and loss, an enormous allowance and much greater than is usually made.

But after all, these can be considered nothing else than rough *comparisons*, it would be next to impossible to approximate with any thing like a satisfactory result, to an equation of the two methods without actual experiment of both, and that under the same conditions of trial. I should in conclusion observe, that the principle by which the water is raised and sustained, is not, as has been erroneously supposed by *capillary attraction* or any material absorption by the belt, but simply from the action of the air about the band, which, partaking also of its speed, passes in a continuous current through the water, and so long as the momentum of this exceeds the gravity of the fluid raised, so long will the column be sustained.

INDICUS.

March 14, 1840.

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* The engine was non-*condensing*, average pressure of steam in boiler 30 lbs. per square inch, above atmospheric pressure.

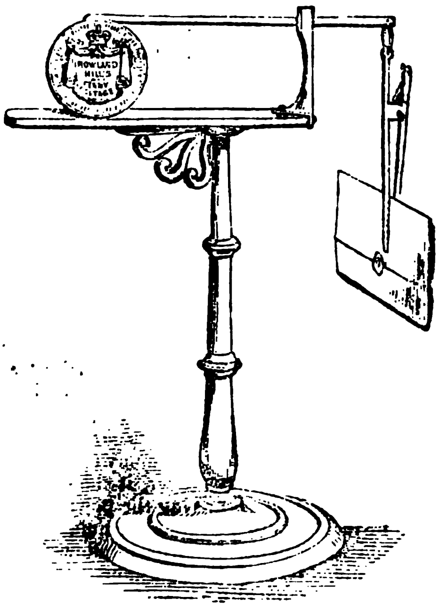
Diameter of cylinder............	8	inches.
Length of stroke	18	"
Number of strokes per minute	50	"

Diameter of drum = 2 1-5th feet ∴ circumference = 6.91 feet. which, making three revolutions for one of the crank shaft ∴ 150 revolutions per minute. Hence, $150 \times 6.91 = 1036.5$ feet = velocity of *the band per minute.*

HOOPER'S REGISTERED POST-OFFICE LETTER WEIGHTS.

The principle of these little machines for weighing letters is that of the good old fashioned steelyards, excepting that the fulcrum or point of balance is changed instead of the position of the weight. In use, the results are the same, and the objects of the change in this case seem to have been a desire to obviate the objections which apply to moveable weights. They are attached to stands and frames of various kinds. Fig. 1 is one variety, the steelyard is

Fig. 1



mounted on a stand. The weight is in the form of a coin at one end of the steelyard, and the letter is held to be weighed by the spring nippers at the other. The construction of these nippers will be understood from the figure. By pressing the upper part between the finger and thumb, the letter will be released, or the nippers opened to receive one.

Fig. 2

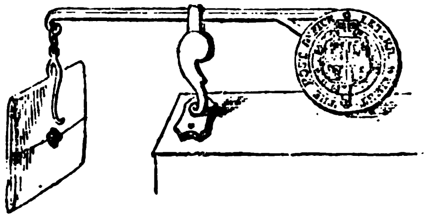
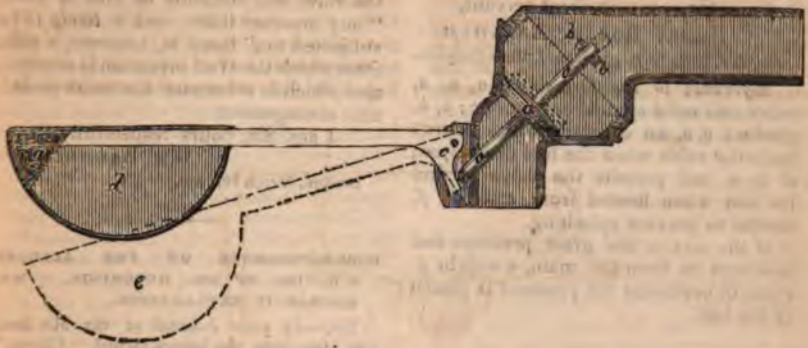
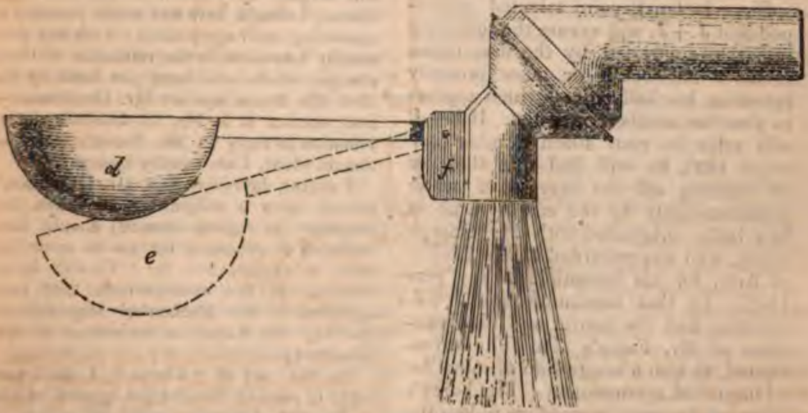


Figure 2 is another form of the same description of balance. It has only a *very short pillar* or fulcrum, and to weigh the letter, this must be placed near the edge of the table as shown in the figure.

K.

ABRAHAM'S PATENT BALL COCK.





Sir,—Having observed in your last number a description and drawing of an improved ball cock worked by two ball levers and cranks, I venture to submit to you a drawing of my patent ball cock, which, with a small ball, and no extraneous arrangement, performs without any friction a full service of liquor, and does not begin to close until the reservoir is filled to the nose of the cock. By the quiet action of the eccentric at the end of my ball lever, regurgitation and jar of the pipe is wholly avoided. Sudden action is indeed an enemy, which, under the pressure of high service cannot fail in producing evil both in the line of duct and in the machine itself, and I apprehend *that its bad effect* would be great in J.+J.'s otherwise ingenious design. In my professional capacity as architect and hydraulic engineer, I have used very many of my ball cocks, and find them valuable from the circumstance that they can neither stick nor fail in shutting. The Great Western Railway reservoir at Paddington, is supplied by one of those of a 3 fall water way, and either with low or very high pressure performs its service with great ease and perfect regularity. They may be made from half inch to three feet service. In a few days I will send you for your inspection a drawing of my locomotive gauge cocks, and should you think either them or this communication likely to interest your readers, I should

feel gratified in finding myself a contributor to your excellent periodical.

I am, Sir, your obedient servant,

HENRY ROBERT ABRAHAM.

March 9, 1840, Torrington-street, Russell-square.

Reference to the Drawing.—*a, a, a,* valve and solid spindle cast in one; *b, b,* guides; *c, c,* an eccentric which throws back the valve when the ball drops from *d* to *e,* and permits the valve to find its seat when floated from *e* to *d*; *f,* cheeks to prevent splashing.

If the service has great pressure and is always on from the main, a weight *g,* equal to overcome the pressure is placed in the ball.

IMPROVED BALL-COCKS.

Sir,—I trust your talented correspondent J.+J. will excuse the following remarks, suggested by the description of his "ball-cock"—or more properly speaking, his ball *valve*—which appears in your last number, page 423. If J.+J. will refer to your 405th number (vol. xv, p. 162), he will find that the idea of shutting off the ingress of water instantaneously by the employment of two balls, originated with Mr. Joseph Farey, who was rewarded by the Society of Arts, for his invention in the year 1817. In that communication J.+J. will also find the merits and disadvantages of Mr. Farey's plan fully investigated, as also a suggestion of mine for an improved arrangement. Mr. Farey's ball cock becomes inoperative unless the water in the cistern sinks low enough to allow the balls to assume the perpendicular position—a defect to which J.+J.'s plan is equally open. The object of my improvement was to remedy this defect, and the result of my modification was, that *to whatever extent the cock might have been opened by the sinking of the water, there it must continue till the cistern was again filled.*

A ball valve very similar in its arrangement and operation to that of J.+J. was manufactured by a plumber (whose name I cannot just now remember) at Hull, some ten years since, in which the descent of the ball caused the tail of the lever to lift the valve and support it till the cistern became filled, when it dropped into its seat and became capable of resisting any pressure that could be applied. In J.+J.'s ball valve the position of the crank is so favourable that the valve will certainly be able to resist "any pressure that a cock is *likely* to be subjected to;" there is, however, a risk, from which the Hull invention is secured, and which is otherwise the most preferable arrangement.

I am, Sir, yours respectfully,

WM. BADDELEY.

London, March 10, 1840.

CORRESPONDENCE ON THE ALLEGED PIRACIES OF MR. HUTCHISON. — MR. MACRAE IN EXPLANATION.

Sir,—In your Journal of the 9th inst. you state that the letters signed "Clovis," were written by me under the direction of Mr. Hutchison. Had I been applied to on this subject by yourself or the Rev. Mr. Bacon, I should have had much pleasure in answering such application: I am not personally interested in the refutation of those charges which have been put forth by the Rev. Mr. Bacon against Mr. Hutchison:—and whether it is Mr. Hutchison's determination to reply to Mr. Bacon's letter or remain silent, I am equally ignorant.

I regret, however, that Mr. Hutchison's silence upon a subject of so much importance (as regards himself) should have rendered it necessary for me to come forward to explain how far "Clovis" is interested in the controversies that have appeared in the *Mechanics' Magazine* respecting the claims to inventions of Gas Machinery.

On the part of "Clovis," I shall now reply to each of the charges applied to him in No. 859 of the *Mechanics' Magazine.*

Mr. Bacon asserts that the letters of "Clovis" have been traced to the defendants in the cause, viz. the London Gas Company. Now, Sir, it can be attested upon oath, that neither the Chairman nor Directors of the London Gas Company are implicated in this affair: as *neither directly nor indirectly,* nor *in any shape or manner* have these gentlemen *interfered with, sanctioned or authorized* the writing or publication of the letters in question.

And, moreover, "Clovis" is in *no way whatever connected* with the legal proceedings instituted in reference to the gas burners nor double gasometer, either as a *witness* nor in any other capacity.

In fact, the first intimation he had upon the subject of law proceedings, appeared in the letters of Mr. Tait and "Justus."

The next charge, which by the bye proceeds from yourself, Mr. Editor, attributes

to "Clovis" the act of having suppressed certain portions of Bacon and Kilby's specification: this, like the preceding charge, is also incorrect. "Clovis" did not read the specification alluded to, he merely referred to the diagram: he had neither time nor inclination to peruse several folios upon the subject of the disputed burners.

In the same paragraph there is an apparent mysterious allusion to (as it would appear) to "a foregone conclusion;" to "Clovis" this sentence is perfectly enigmatical. Perhaps, Sir, you will explain this seeming riddle:—the sentence runs thus:—"We need scarcely add that, after what has passed ("Clovis" will understand what we mean), any reply to this paper must be signed by the real name of the author."

The Rev. Mr. Bacon speaks in rather harsh terms of "Clovis" for having given publicity to the excellence of inventions which, in his humble judgment, he *sincerely believed* to be *the genuine productions of Mr. Hutchison.*

As the panegyrist of those inventions, this writer merely performed the part of an advocate in favour of *one* who was *distinctly described to him as the original inventor.* Memorandums are now in the possession of "Clovis," *furnishing him with* the *particulars* of the inventions he was *desired* to write upon: the written articles were also *transmitted* to the inventor *for perusal* previous to their publication in the *Mechanics' Magazine.*

This being the case, "Clovis" had no right, nor was it his province to doubt the integrity of the *party* who furnished those memorandums, and particularly as this *party held an appointment,* which "Clovis" was justified in believing to be an undoubted guarantee for the honesty of the statements placed in his hands for publication in a respectable journal. Therefore the commendatory articles were written under the *positive assurance* and *impression* that all that was said in favour of Mr. Hutchison was capable of being supported by the *most irrefragable proofs.* With respect to the Vice-Chancellor's decision in the Burner case, "Clovis" was supplied with the particulars in the same manner as already described.

The specifications of Mr. Hutchison's inventions "Clovis" *has never seen*—not even a copy of this *instrument has ever fallen under his observation.*

In turning over the volumes of your Work, I observe several eulogistic articles upon Mr. Hutchison's invention, signed "Ensor;" they are disowned by "Clovis," *he does not know* even the source of the *authorship.*

I have already declared my ignorance of what Mr. Hutchison's intentions are in reference to the charges against him:—I am not, nor *never have been in his confidence.* I have performed my duties as a servant to a public company since 1834, I trust, to the satisfaction of my employers, without being in any way *personally connected* with Mr. Hutchison's interest or his patent rights.

I am, Sir,
Your obedient Servant,
D. MACRAE.

Bayswater, 9th March, 1840.

[We readily publish Mr. Macrae's explanation of his share in the unpleasant transactions referred to; and we freely acknowledge that it places his conduct in a very different light from that in which it first appeared. We are surprised, however, that Mr. Macrae should persist in putting a meaning upon Mr. Bacon's first letter, which Mr. Bacon has himself already so distinctly disclaimed, viz. that by using the expression, "the defendants in the cause, the London Gas Company," he meant to impute the letters of which he complains, to the Chairman and Directors personally. It must be admitted on all hands, that no one has a right to hold a whole Company morally responsible for the misconduct of any of its officers, and this distinction Mr. Bacon seems to us fully to recognize throughout the whole of his first letter, the charges in which are now proved to demonstration by Mr. Macrae's statements.

We must also add, that sincerely as we may lament any unjust interpretation to which Mr. Macrae may be exposed, it was not *very natural* that we should *conjecture* that the numerous eulogies of Mr. Hutchison's patents *proceeded from the Patentee himself!* Much less can we blame ourselves for concluding that Mr. Macrae was the writer of the letters complained of after Mr. Hutchison's *unequivocal denial* that he was *himself the author,* and his observation that he saw no objection to our "*disclosing the authority under which we permitted the insertion of the article alluded to.*"*

Whatever might have been our own private opinion of Mr. Hutchison, it was too much to expect that we should have been prepared to anticipate *from any quarter the unexampled treachery, which to screen itself betrays a friendly amanuensis.* ED. M. M.]

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* See this letter in our No. for the 7th instant, p. 425; the article referred to is the partial and inaccurate report of the judgment of the Master of the Rolls.

DEFECTS IN MACHINE-MADE PAPER.

Sir,—Having seen a letter in your very valuable Magazine of last month, page 389, from Mr. Smith, on two faults in the Paper Machine, it struck me that I had seen one of the faults corrected whilst visiting some mills in Scotland last summer; that is if the fault (viz. want of strength) was caused by what Mr. Smith says, which I have no doubt would tend greatly towards it. But I rather think that the fault he complains of is caused nine times out of ten by using a bad material. Perhaps Mr. Smith will say, why was not that the case when paper was made by hand? The answer I would make is, that the demand for paper was not so great then as it is now, consequently there was not such a demand for rags and ropes; but now, the demand for paper exceeding the supply of good strong materials, manufacturers are obliged to substitute other things in their place. Besides this, the price of paper is reduced extremely low, in consequence of the great opposition that there is now in this trade. If a manufacturer was to use a good material he could not meet the markets, so he is obliged to substitute a bad material: it therefore stands to reason that the paper cannot be so strong. There is an old saying, "opposition is the life of trade." But, believe me, Sir, that too great an opposition is as bad as an overdose of medicine to a sick man, it will kill before it cures. But I have trespassed too long on your valuable time; so now to "cry back," as we say out hunting. While visiting some mills in Scotland last summer, I examined among others, Mr. Laing's of Balerno. There were two machines at work, making brown papers: Mr. Laing very kindly went through his concerns with me. While going through, we happened to be speaking of the inferior materials put in paper now, and its want of strength, &c., he then told me how he managed:—he put good sound rope in; and the cylinders were brought to that degree of heat, that the paper on coming out had a damp feeling; and after it was cut he had it hung on the lines in the drying loft for one or two days. This I think would correct the fault Mr. Smith complains of, if caused by what he says, viz. too quick drying. Now, although I have thus far taken part with machines, they are no favorites of mine. I would sooner see our five vats at work than see twenty machines in their places. Where will you get a sheet of machine paper to compare with a sheet of laid Imperial?—aye, or even with the lowest hand paper, blue laid pot?—no where; neither now nor hereafter!

I remain, your obedient Servant,

WILLIAM PICKERING PHAIR.

Butlers Town Paper Mills, Cork, March 10, 1840.

INSTITUTION OF CIVIL ENGINEERS—SESSION 1840, ABRIDGEMENT OF ANNUAL REPORT.

The Council of the Institution of Civil Engineers, on resigning the trust confided to them by the last annual general meeting, solicited the attention of the meeting, and of all those who are interested in the welfare of the institution, to the following report on the proceedings and on the state and prospects of the Institution, at the close of this the 21st year of its existence. At the last annual general meeting, the council of the preceding year had the gratification of congratulating the Institution on its then assembling in its new premises under circumstances which furnished so advantageous a contrast with the condition of earlier years, and such convincing evidence of the steady progress and success which had attended the labours of the Council and the co-operation of the general body. And though the year which is now closing might not have been marked by events of so striking a character as the preceding one, the council nevertheless experienced the highest degree of satisfaction in reviewing the proceedings of the session of the year so auspiciously commenced. After referring to some alteration in the laws of the Institution, and making some just remarks upon the advantages and importance of immediate publication of papers communicated to the Institution, and the discussions to which these timely publications gave rise,—the Report proceeds thus:—

No one can turn over the minutes of the last session without remarking the number and the diversity of the facts and opinions there recorded, very many of which were elicited by the statements contained in some written communication, or casually advanced in the course of discussion.

The council cannot omit this opportunity of insisting on the importance of these discussions in promoting the objects which the Institution has in view. The recording and subsequent publication of these discussions are features peculiar to this Institution, and from which the greatest benefits have resulted and may be expected, so long as the communication of knowledge is solely and steadily kept in view. It would be easy to select many instances during the last and preceding sessions, of some of the most valuable communications to the Institution owing their origin entirely to this source. The first communication from Mr. Parkes arose entirely out of the conversations which took place on the superior evaporation of the Cornish boilers being referred to as one cause of the great amount of the duty done by the Cornish engines. The communication by Mr. Williams

it and resin fuel, owes its origin to his accidentally present at the discussion on es of turf in the manufacture of iron; that by Mr. Apsley Pellatt, on the re- heating powers of coke and coal in g glass, arose entirely from the discus- f the facts stated by Mr. Parkes re- ng the superior evaporation produced coke from a given quantity of coal than coal itself. And lastly, the extremely sting and highly valuable discussions at ommencement of last session on the nd applications of turf; and on the ex- inary coincidence between the results ed by Mr. Lowe, Mr. Parkes, Mr. y Pellatt, and Marcus Bull, of Phila- a, experimenting, as they did, with different views, and under totally dif- circumstances, must be fresh in the re- tion of all present.

, besides the positive advantages which thus resulted, and may be expected, a steady adherence to these practices so ar to this Institution, there are others greatest value to those engaged in cal science. By this freedom of discus- statements and opinions are canvassed, orrected or confirmed, as soon as pro- ted, the labours of authors and claims lividuals are made known and secured tter of history—and attention is con- ly kept alive to the state and progress owledge in those departments of science it is the especial object of this Institu- o promote. The council trust, there- that those individuals who have stored owledge and facts for many years past, levoted themselves to some particular h of science, will consider how much have in their power to contribute, and great is the assistance which they can r to the labourers in other branches, above all, to those who are ambitious lowing in their steps, by freely commu- ing, either orally or in writing, the ledge which they have collected; so that ecords of the Institution may be un- leled for the extent and correctness of formation which they contain.

e communication by Mr. Jones, on the minster Sewerage, is of the most elabo- and costly description. The council ived that, in awarding to Mr. Jones a rd medal in silver and 20 guineas for aborious communication, they were be- ng a suitable mark of approbation on uthor of a record which is nearly un- leled, and must be of great value as a e of information in all future works of nature, when other, and particularly gn, cities carry into effect a system of age, in which they are at present so de- it.

The communication by Mr. Hood calls for distinction. It contains a detailed account of the principles on which the salubrity of the atmosphere in crowded rooms depends, and the various methods which have been adopted for warming and ventilation.

The council have also awarded a Telford medal in silver to your associate, Charles Wye Williams, for his communication on the Properties, Uses, and Manufacture of Turf, Coke, and Peat Resin Fuel; and to Mr. Edward Woods, for his communication on Locomotive Engines.

The communication by Mr. Edward Woods, published in the second volume of the Transactions, will always bear a prominent place among the records of practical science, as one of the earliest and most accurate details on the actual working of locomotive engines. The first communication was received early in the session of 1838. The author was thought capable of adding so much to his already valuable communication, that the council referred it back to him for this purpose, and it was not received in the form in which it appears in your Transactions till after the premiums for that session were awarded. It gave an accurate account of the progress of the locomotive engines on the Liverpool and Manchester Railway from the opening of that important work. The experience of engineers had at that time furnished them with but little knowledge as to what were the most essential requisites in railway engines, and the advance of knowledge, as shown by the history of the locomotive engine on this railway, is a most interesting and instructive lesson to every one who would study the progress of practical science and improvement. Great alterations were found necessary in the strength of the parts, in the weight of the engines, in the road, and the number of wheels. The first engines were gradually adapted to the necessities of the case, and the arrangements then resorted to as necessary expedients have now been adopted into the regular and uniform practice. Besides the extreme interest of that which may be termed the history of these improvements, the communication is replete with theoretical principles as to the working of locomotives, and the advantages and disadvantages incident to peculiar practical adaptations. It would exceed the limits of this report to do more on the present occasion than briefly to state that this paper contains extended remarks on the relative advantages of four or six wheels, of inside or outside framings, of crank axles or outside crank pins, of coupled or uncoupled engines. The council would point out this paper to the junior members of the profession, as an example of how great a service may be ren-

dered by simply recording what passes under their daily observation and experience.

The council have also adjudged a Telford medal in bronze, and books to the value of three guineas to Mr. R. W. Mylne, for his communication on the well sunk at the reservoir of the New River Company at the Hampstead-road; to Lieutenant Pollock, for his drawings and description of the Coffer Dam at Westminster-bridge; and to Mr. Redman, for his drawings and account of Bow-bridge.

Among the other communications of the session, the council cannot, on the present occasion, omit to notice those of your member, Mr. Parkes. His communication on the Evaporation of Water from Steam Boilers, for which a Telford medal in silver was awarded during the preceding session, and the interesting discussions to which it gave rise, are too well known to require further comment. But great as were the benefits conferred on practical science by the facts there recorded, they have been much surpassed by the subsequent labours of this author. In continuation of his subject, you received early in the session the first part of a communication on Steam Boilers; and at the close of the session, the second part, treating of Steam Engines. Before Mr. Parkes was induced to turn his attention to the preparation of these communications, no attempt had been made to bring together, in one connected view, the various facts which had been ascertained. The economy of the Cornish system was indisputable; but to what it was to be referred was involved in some obscurity. It was reserved for this communication to call attention to certain quantities and relations which exerted a peculiar influence over the results; and which, being rightly ascertained, were at once indicative or exponential of the character of the boiler. If it be found that, in one class of boiler, the same quantity of coal is burnt eight times as rapidly as in another class—that the quantity consumed on each square foot of one grate is twenty-seven times that on the grate of another—that the quantity of water evaporated bears some definite relation to the quantity of heated surface—and that there is twelve times more evaporated by each foot of heated surface in one class of boiler than in another—and finally, that the quantity of water evaporated by a given weight of fuel is in one class double the quantity evaporated in another,—we have arrived at some definite relations whereby to compare boilers of different kinds with each other. To these definite quantities and relations, the author, with apparent propriety, assigns the term "exponents;" and these being compared together for different boilers, their respective merits as evaporative vessels are readily perceived. Mr. Parkes has also called the attention of engineers to the effect of the element time, that is, the period of the detention of the heat about the boiler. The importance of attending to this cannot be too strongly insisted on; as it would appear from these statements, that boilers being compared with each other, in respect of their evaporative economy, are nearly inversely as the rate of combustion. Attention is also called to the fact, that there are actions tending to the destruction of the boiler entirely independent of the temperature of the fire, and which may be designated by the term, "intensity of calorific action." Of their nature we know nothing, but the durability of different boilers, under different systems of practice, affords some means of comparing the intensity of these actions.

Mr. Parkes having, in the first part of the subject, thus pointed out the distinctive features of the different classes of boilers as evaporative vessels, proceeds, in his subsequent and concluding communication, to consider the distribution and practical application of the steam in different classes of steam-engines. And for this purpose, he is led to consider the best practical measure of the dynamic efficiency of steam—the methods employed to determine the power of engines—the measures of effect—the expenditure of power—the proportion of boilers to engines—the standard measure of duty—the constituent heat of steam—the locomotive engine—the blast and resistance occasioned by it—the momentum of the engine and train, as exhibiting the whole mechanical effort exerted by the steam—the relative expenditure of power for a given effect by fixed and locomotive non-condensing engines. This bare enumeration of the principal matters in the sesond communication, will give some, though a very inadequate, idea of the magnitude of the task undertaken by Mr. Parkes, for the communication is accompanied by elaborate and extensive tables, exhibiting the results of the facts which he has collected and used in the course of his inquiry, and it may confidently be asserted that a more laborious task has rarely been undertaken or accomplished by any one individual than the series of communications thus brought before the Institution.

It is announced through the medium of the last Annual Report, that the monument of Telford was nearly finished, and that a site had been selected in Westminster Abbey. The council have now the satisfaction of announcing that the monument is fixed in the place destined for it, and they are confident that all who enjoyed the acquaintance, or

the merits, of the late distinguished lent of this Institution, will rejoice that emory of one so eminent and so highly ring, has met with so proper and just a e of respect; whilst all, no less than by whose liberality the monument was d, will feel that he has a name which ndure so long as there exists a record triumphs of the British engineer.
would be vain to expect that an annual ng should ever recur without the coun-ving to lament the removal by death of who, by their acquirements, or by their ations of friendship, were endeared to istitution. On the present occasion the il have to lament the death of yuor ers, Mr. David Logan and Mr. Henry erley Price, and of your honorary mem-Mr. Davies Gilbert. Mr. Davies Gil-vas, by his writings and his influence, it benefactor of practical science, and ransactions of the Royal Society, over he presided for three years, contain il papers of great value to the practical eer. He took great interest in the in-ction of Mr. Watt's improvements in team-engine, into the Cornish mines, in the controversy betwixt Mr. Watt Mr. Jonathan Hornblower, respecting ng steam expansively, the former em-g one cylinder only, the latter two cy-s, in the manner afterwards revived by f; the theoretical efficiency of the two ds being identical, but simplicity and anical advantage being greatly in favour former, as its present universal adoption es. Mr. Davies Gilbert introduced ractical mechanics the term "efficiency" product of the applied force and of ace through which it acted in contra-ction of the term "duty," as indicative imilar function of the work performed. ttention was also directed to the theory spension bridges, when the plan for g such communication across the i was submitted to the commissioners nted by parliament. It appeared to hat the proposed depth of curvature of tenary was not sufficient, and his well-n theoretical investigation of this sub-vas undertaken with the view of ascer-g this fact; and in consequence of these tigations, the interval between the points pport of the chains and the roadway was sed to the height which appeared to equisite for works of this nature. The rs of this distinguished individual for omotion of science were unremitting. as the founder of several societies; he he discoverer and early patron of the s of Davy; and while in parliament he red most assiduously in the advance-of all the public works. Regret for such a man, exerting the power of his mind so advantageously and through so many years, must always be strong and sincere; but having attained the ordinary limit of human life, he sunk into the grave amidst the respect and esteem of all who knew him, and has left behind him a name which will ever bear a prominent place amidst the names of those whose lives and talents have been devoted to great and noble purposes.

ON DRY ROT, AND THE DECAY OF STONE AND WOOD. BY SIR A. CARLISLE.

Copy of a Letter from Sir Anthony Carlisle, to M. I. Staunton, Esq.

"My dear Sir,—In reply to your application to me on the subject of dry rot in timber, I may justly state that the question is extensive, and it includes a variety of knowledge.

"Many different sorts of decay invade all kinds of timber, and the term "*dry* rot" is often improperly applied, especially to the decays, which entirely depend on *humidity*.

"There are two different kinds of destruction of timber, each of them essentially connected with humidity. One of them being produced by a parasitical fungus, which absorbs the fibres of wood when subjected to moisture, and thus disorganizes the natural fabric of wood.

"The other mode of destruction is by decomposition, which may be correctly termed "*rot*," and this occurs from alternate *wet* and dry.

"The solidity of timber is not so durable when the tree has been filled with its growing portion of *sap*; and an unwise Act of Parliament, made to facilitate the barking of oaks, in order to increase the profits upon bark for tanning, directed the felling of those trees after the sap had risen in the spring season, so as to loosen the bark.

"I foretold the injurious consequences of this Act upon the English navy as a certain cause of fungus rot, but landlords and their ignorant stewards disregarded me, and the Admiralty were soon obliged to doctor all the new built ships for that incurable decay.

"That the absence of moisture secures every sort of timber from decay is shown by the ancient Mummy Cases of Thebes, by the bare roof of Westminster Hall, and the roofs of all our cathedrals and old churches, whereas the modern custom of plastering or painting all wood-work confines the moisture and excludes the air, to the certain destruction of timber, as much as if the beams were fixed endwise in water. The Museum Roof of the London College of Surgeons was thus rotten, within thirty years, and the underground

wood-work in every damp house is ruined in a similar manner.

"The elementary matter of wood is termed carbon, a word comprising solids and solutions, possessing apparently different properties, and on an exact and especial knowledge of all these depend the practical uses of those differently modified substances.

"The well known charred wood, charcoal, the gas termed carbonic, the soluble gum Acacia, and the fluid element of sap of all vegetables, even a cambric handkerchief, are only different states of the same material. But the insolubility of *charcoal*, and the easy solubility of gum Arabic, are opposites, and show the diversities of the carbonic element. Crystallized white marble is a salt of lime, formed by carbon, but not in a state of gas, and in that state it was for a long time called *fixed air*. There are many intermediate states of carbonic fixity; and the rotting of timber exhibits them wherever the fluid sap, as before mentioned, is exposed to decomposition. A remarkable example of this occurs in fishermen's nets, in the herring and mackerel seasons. If the nets so used be suffered to remain even for eighteen hours embued with the mucus and fat of the fish, they heat, ferment and rot, so as to be utterly worthless; and a similar injury happens to grass-bleaching linen, when long confined under snow; likewise in the washing of linen, if it be long exposed to putrescent materials; this fermentation is the putrefactive, and it destructively decomposes the solid carbon of the net, or cloth.

"Stones which *retain* or *imbibe* water to excess are, therefore, unfit to be placed in contact with timber in buildings where the construction is designed to be durable.

"Kyan's patent for steeping timber in a solution of mercurial sublimate is only a partial and temporary preventative of *rot*. I gave evidence on that subject before a committee at the Admiralty, but the members were not sufficiently instructed to understand my attempts to illustrate the nature of organic fabrics. You may, however, be assured that it is not a little knowledge that can determine such complicated inquiries.

"If any members of your committee wish to know my further views, I should willingly meet them.

"My dear Sir, yours truly,

"Anthony Carlisle.

"Langham-place, Feb. 22, 1840."

NOTES AND NOTICES.

Parkin's Patent Wooden Wheels.—Sir,—If Mr. Parkin will take the trouble to refer to the 31st vol. of the *Mechanics' Magazine*, page 35, he will find himself anticipated in the application of wood to the *peripheries* of railway *carriage*-wheels:—I say *carriage*-wheels, for I can scarcely imagine he seriously proposes wooden rims for the engine *driving*-wheels, it being difficult sometimes to obtain a sufficient bite, even by the friction of iron upon iron; and I say *peripheries*, believing that railroad wheels have long ago been constructed partly, if not chiefly, of wood.—I remain, Sir, &c.,

J. R.

London, 12th March, 1840.

Mr. Walter Hancock, on Friday last, made a trip to Barnet, with his steam-carriage, "Automaton." The carriage started from Stratford at half-past ten o'clock, and arrived at Finsbury-square at eleven; after waiting there half an hour for a party of gentlemen who were to accompany him, the carriage started for Barnet at half-past 11, in gallant style, reaching that town at 20 minutes to one—stopping ten minutes at Finchley common to take in water, thus doing the distance to the Green Man, at Barnet, thirteen miles, within the hour. After taking refreshment, the party returned to Finsbury-square at the same average speed, all perfectly satisfied with the excursion, and concurring in opinion that this trip was one of the best ever performed by steam on the common roads. The carriage returned by way of Hackney road and Bethnal-green to Stratford; the whole distance 36 miles. It is said that the engine is to run on the Barnet road as often as parties interested in this mode of conveyance may wish to test its power and efficiency.

Improvement in Omnibuses.—Several correspondents have lately suggested a very convenient addition to the interior of an omnibus. We have seen the plan already adopted in several cases, but it is not generally so; one correspondent says: "Those persons who are in the habit of using this method of conveyance have, no doubt, often felt the want of a something on which they might hold when they have just entered. To remedy this, let a rail run longitudinally down the centre, depending an inch or two below the roof of the 'buss.' The driver generally drives on immediately you are on the top step, not allowing you time to seat yourself, rendering it absolutely necessary that you should receive some support till you are fairly seated; which support is now obtained at the expense of many annoyances to your fellow passengers, and which, I think, might be entirely obviated by the adoption of this simple expedient."

Railway Telegraph and Bell Ringer.—Mr. Nicholson, of Boston, (U. S.) received a gold medal from the Mechanics' Association of that city, for his invention of a telegraph so arranged that being placed either upon a railroad, or near it on any height, is made to give a signal by the operation of the passing of the engine; and the time which elapses after the passing of the engine is indicated by a clock-work movement of the arm of the telegraph, which gradually falls to its place of rest in a fixed period of time. The bell is suspended over a railway crossing, and is made to give notice of the approach of the train, by means of a covered wire along the track of railway for the distance of a quarter of a mile. The bell rings until the engine passes.

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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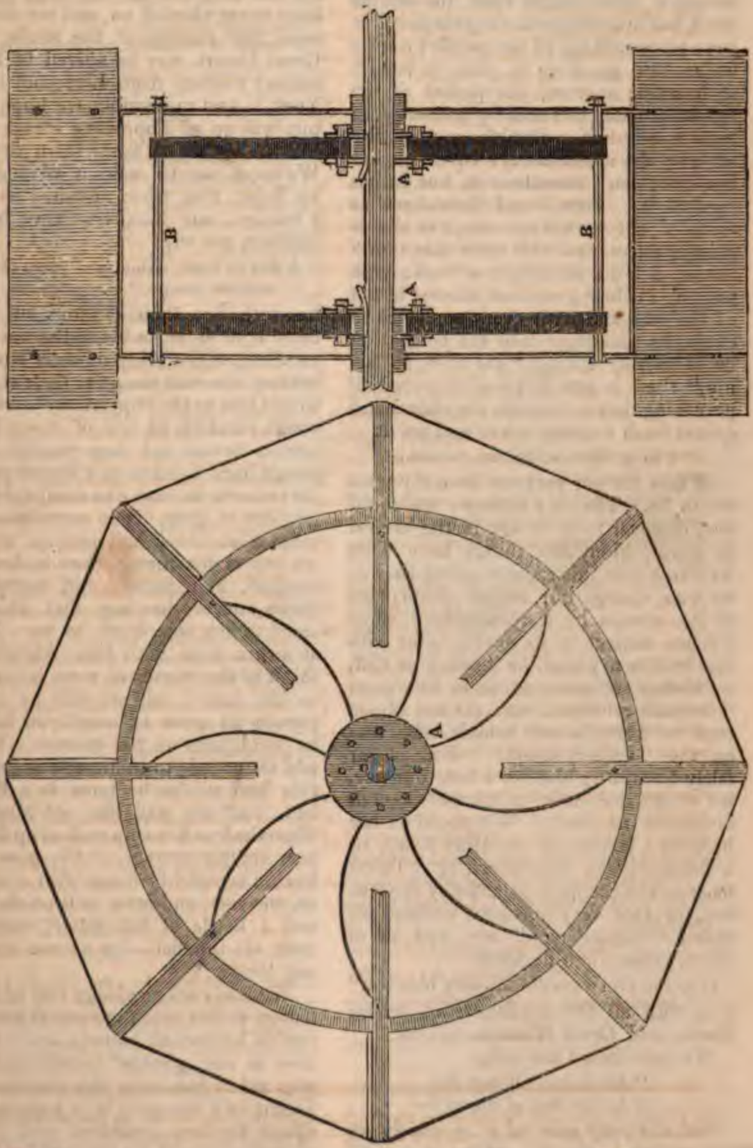
ADAMS'S AND BUCHANAN'S PATENT SPRING PADDLE-WHEELS.

Fig. 2.

Fig. 1.



ADAMS'S AND BUCHANAN'S PATENT SPRING PADDLE WHEELS.

It is an acknowledged defect in vessels moved by steam power, that the tremulous vibration impairs the comfort of passengers, and where long-continued, affects their health unfavourably. The vibration arises partly from the engine itself, but in a still greater degree from the successive striking of the paddles on the water. So great is it, that in vessels with single engines, the period of the full stroke may be timed by persons with their eyes shut. Double engines, by making the speed always equal, render the effect more monotonous, but do not remove it. Fitted and furnished, as some of our vessels now are, like shore-going palaces, and with their large bulk almost defying sea-sickness itself; with nothing in their gorgeous saloons to tell of the sea, and with every appliance to cheat the passenger into the belief that he is merely taking "his ease in his inn," there is yet this one universal all pervading defect to break the charm and quiver forth in every nerve and pulse,

"I'm on the sea, I'm on the sea!"

Where for our part we devoutly wish *not* to be. The only pleasure we could ever discover in a voyage is the arrival in port. Many fine things have been written about this same sea, but they in no wise change our cordial abhorrence of it,—always be it remembered, when we are subject to its power,—for with our foot on dry land, be it beach or cliff, we always recognise ocean to be a most "delicate monster," and do not object even to a rough and tumble with him on the "yellow sands." But as for fairly bestriding him for a long journey, we would decline it in all but cases of invincible necessity. We would rather bestride a jackass in the Holy Land, or a dromedary in the Desert, or a Tartar hack in the Steppes, or a shelty in Orkney, or that very universal conveyance called "shanks' nag," any, and all of them, rather than be borne

"O'er the glad waters of the dark blue sea,"

even with all the appliances of *British Queens* and *Great Westerns* to boot.

We have heard the song,

"As we lay, all that day
"In the Bay of Biscay"—

But the only part of it to which we *could respond,* was the "Oh! oh! oh!" thinking of the poor schoolmaster in the like predicament, with his one idea, exclaiming, when he heard—

"Britannia *rules* the waves,"
"I wish she'd rule them straighter!"

The fact is, all these fine things have been invented to cheat people into a belief that they were not sea-sick; but they have never cheated us, and we devoutly wish that enough of the sands of the Great Desert may be spared to form a railway viaduct from Liverpool to New York. And meanwhile, we hope inventors will go on improving steam vessels till we may try to fancy them dry land. We hope, not to make a voyage,—but we hope, that when doomed to make a voyage, our next trip may be in a steamer, not with

"A flag to brave a thousand years the battle and the breeze,"

but with five thousand tons burden, or more if need be, to brave the unruly caracolling of the briny monster—to fairly overlay him with the *peine forte et dure*—to put him to the "question,"—ride him rough shod till he tire of it—to plough a wake broad and deep enough in his rough back to serve as a blazed path for the return, in case the compass should get out of gear. The merciless old tyrant! that never had pity on us when we lay at his mercy, but kicked, and lurched, and rolled, and roared with mirth, never heeding that what was sport to him was death to us. We are at sworn feud with him whenever we think of the chance of ever being again in his power, and we will be art and part in all plots to overthrow him, till he fairly gives up the contest. We will add thousands to thousands of tons, and ride him till he be tame as a Barbary hen, and cry out, like old Missisippi, when the first fire-ship rushed up through her rolling current, "I'll give it up. Such a tarnal big canoe with a saw-mill on one side, and grist mill on the other, and a kettle of hot water, enough to cook all the fish—its no use trying it any longer."

We fairly acknowledge that our indignation at this villanious sea-sickness carries us beyond all bounds, and we recognise as our greatest benefactors those who aid in removing the chances of it. In our own steamers it is lessened in its effects by their increased size, but the vibration caused by the paddles is most

unpleasant. It is very droll to watch the effect on the various classes of passengers seated quietly, or trying to be seated quietly in the saloon. There is an old lady at the upper end seated near a pier glass nodding at her own shadow, and looking as if she had the palsy. Do what she will she cannot help it. Close by her is a very pompous gentleman anxious to be dignified. He does his best, but he too has the palsy. The steward brings him a glass of negus to aid in composing his dignity, but to no purpose—the negus has the palsy too. A soft complexioned dandy is trying to read a novel with aristocratic immobility, but he is forced in this case to acknowledge the principle of universal equality, in palsy. The lady who is doing her best to look languishing loses the effect of her efforts in spite of herself. The proud beauty with luscious dark eyes calling forth music from the piano, cannot produce clear sounds—the piano has the palsy, and its sounds are thick. Her sister's voice trying to keep time with her "jangle's harsh discords." That stout old gentleman redolent of turtle, and "with good capon lined," who looks as though he were a sheriff from Farringdon Within; escaping the vengeance of the Commons House by a trip to "Aour Country," is shaking his fat sides without laughter. The very lamps have caught the infection, and are shaking their oily sides. The chessmen at yonder table are making moves without the aid of the chess players, a greater marvel than the famed automaton, and a general St. Vitus's dance has taken possession of all bodies both natural and artificial. There is only one face of satisfaction—that of the old man, who, having the palsy before he embarked, now finds himself no worse than all those around him in the same predicament. The ship seems bound on a voyage to China, and all the passengers are practising to wag their heads like Mandarins;

"For they're a'noddin, in our ship at sea."

We hear of the laws of motion, and universal motion, and perpetual motion, but we confess that we never saw them so perfectly exemplified and with such universal harmony as in a steam boat.

But it is a harmony which all passengers are desirous to be rid of, and attempts have occasionally been made to modify it, by placing the paddles obliquely, and also by dividing the boards into steps, both in width and length, but all these modes have been found to occasion a loss of speed. The broader and more even are the surfaces of the boards the better hold have they on the water, which is the fulcrum acted on by the engine. If the speed of the engine be too great, the shocks of the boards striking the water are so increased, that the vibration goes through the whole vessel, and that portion of the engine power which produces this annoyance to the passenger is so much deducted from the speed of the vessel. If, therefore, means can be contrived to prevent this vibration reaching the vessel, and of confining it to the paddle-wheels only, it follows that the wheels may with great advantage be worked at a greater number of revolutions per minute, and consequently, with the same amount of engine power the speed may be increased. A recent invention of Mr. Adams, the author of "English Pleasure Carriages," associated with Mr. Buchanan, bids fair to accomplish this object.

Fig. 1 is a side view, and fig. 2 a cross section of the improved paddle-wheel. The wheel is made to run loose on its shaft like the wheel of a carriage. A pair of double flanges A, are firmly keyed on the shaft within the frame of the wheel. To these flanges are attached by bolts passing through them, a number more or less according to the desired strain—of curved springs, the ends of which have eyes to enable them to move on the bolts. The other ends of the springs have similar eyes, which are attached to bars B, passing through the frame of the wheel near the paddle boards. By this arrangement the wheel is enabled to turn on its shaft either to the right or left, in which case the springs begin to draw out in length, and if sufficient force be applied wholly to overcome the elastic resistance, the springs will at last be drawn to a straight line, when the movement of the wheel round the shaft will cease. It is therefore obvious that the springs cannot be broken by any force less than that necessary to tear the metal asunder by longitudinal tension.

When the board of an ordinary paddle wheel which is keyed fast on its axis, strikes the water with violence, the direct tendency is to twist the shaft, or in default of this, to put a strain on the

whole of the machinery, and cause the vessel to vibrate. But when the board of the improved wheel strikes the water the shaft is not acted on except through the agency of the springs, which yield simultaneously; and the force which in the fast wheel is employed to strain the machinery, is in the loose wheel employed to stretch the springs. With the fast wheel the power is dissipated and lost in vibrating the vessel. With the loose wheel the power is lodged in the springs which will continue to give it out again by reaction.

A steam vessel may be regarded as a wheel carriage, propelled by driving wheels though not supported on them. In both cases, land or water, the concussion comes through the agency of the wheels. In land carriages, where speed is used, springs cannot be dispensed with; in the words of Mr. Davies Gilbert, "they convert percussion into simple increase of pressure." Precisely such must be the result of applying springs between the axles and wheels of steam boats. The application is so extremely simple, that any existing vessel may be furnished at a small expense. By simply removing the keys and allowing the wheels to revolve, they will be ready for the application of the spring fastenings. As a provision against rust, the springs may be first tinned and then japanned, in which case they will last for years. We can scarcely imagine a case of breakage from violence on account of the tension being lengthlong with the spring, but the whole of the springs might be taken out and replaced by an ordinary workman in an hour or two, with the vessel lying to at sea. And in fact, the wheels being provided with the ordinary fastenings, they might in any case be keyed fast on their shafts as usual.

As to the saving of concussion, there can be hardly two opinions, but we shall be curious to know the amount of increase in speed which ought to be a concomitant result.

It is proposed to apply the same principle to the driving wheels of locomotive engines, and also to machinery generally, for the purpose of equalising the movement and preventing the jerks and snatches which arise from the slightest irregularity in rigid gear. We think, that for the fly wheels of turning lathes this principle may also be very valuable, and [illegible]wise for communicating movement [illegible] tools for surface cutting.

CURTIS'S AND ENGLAND'S PATENT TRAVERSING SCREW JACKS.

Sir,—I observe in the last number of your Magazine, an engraving and description of "England's Patent Universal Screw Jack," which is an unwarrantable evasion of my "Patent Traversing Screw Jack," an engraving, and description of which, appeared in your Magazine for Feb. 22, No. 863. By comparing the engravings and descriptions, the identity of purpose, will be apparent; and it will be equally evident, that the strong iron frame B, and screw C, with the ratchet lever E, of England's arrangement, are a purely mechanical substitution for the plank D, lever E and rack H of my arrangement. My patent was sealed 31st August, 1838, and England's, May 7, 1839, a difference of nine months in my favour. Upon discovering this invasion of my patent, I made representations to Mr. England, and offered him very liberal terms rather than incur the expense of legal proceedings against him; but these failing, I instructed my solicitor to commence an action to restrain him from making the apparatus. Upon enquiry at the Great Western Railway, I learned that England's jack was found invariably to fail in practice; that whenever it was attempted to traverse the jack with the load upon it, by means of the lying screw, the jack invariably upset, and it was found consequently useless; I learned also, that it had been tried upon the Southampton Railway, and was found useless; it had been offered to the Croydon Railway, but they refused even to receive it, as it was considered wholly unfit for their use. Mr. Bury, of the London and Birmingham Railway stated to me, that one of England's jacks was at Camden Town, but they had not used it. I found it had been used upon the Eastern Counties Railway, with better success, but one of the engineers told me, that a common jack was generally used to assist the traverse of the screw. Upon receiving so many distinct and independent testimonies that England's variation of my invention was certain to die a natural death, I directed my solicitor to suspend proceedings, as I conceived the best way to settle the matter was to leave England to his fate. I have only to add, that my invention is liable to none of the objections to which England's is obnoxious; that it has been proved upon the Croy-

don, South Western, and the Great Western Railway with complete success; and that upon the last mentioned Railway, although such extraordinary violence was used in the trial, that the diagonal bar F, was bent, and the lever E likewise, yet the engine was pulled over upwards of 18 inches by two men with great facility. This fact I state upon the evidence of one of the men who assisted upon the occasion.

I regret to have drawn out my observations to such length, but in justice to myself and the public, I feel bound to go into this statement, and shall feel much obliged by your insertion of this letter in your excellent journal.

I remain your obedient servant,

W. J. CURTIS.

15, Lower Stamford-street, Blackfriars-road, March 19, 1840.

SAFETY LAMPS.

Sir,—Allow me to say that within these six months, two safety lamps—that of Sir Humphry Davy, and that of Messrs. Upton and Roberts, *both* of which had *exploded* in their respective coal receiver's hands, have been submitted to me; the former in Derbyshire, and the latter in Staffordshire. These lamps had exploded from the *same cause*, and I hope I do the miner a service in explaining the reason of the accident, and pointing out the means for preventing a recurrence of the danger.

The wire gauze at the bottom, where it should be in *perfect contact* with the ring or rim which screws into the air cistern, is often torn, and displaced by the acts of screwing and unscrewing the wire gauze cylinder. The flame from within issues through these rents and loopholes, and explodes the ambient atmosphere. From thence in Upton and Robert's valuable invention, it ascends between the exterior surface of the wire-gauze and the envelope of glass. This defect in both these lamps is so easily remedied by a ring and rivets, that it is only necessary to advert to the means.

In one of my experiments with a Davy, it exploded from this cause, but it was rendered secure by applying a little glazier's putty to the junction above the ring.

I remain, your humble servant,

J. MURRAY.

March 19, 1840.

PEN AND INK.

Sir,—There are few questions of more interesting import in the economy of life than—pen and ink. These two little words with their necessary conjunction, are fraught with no ordinary value to thousands and tens of thousands. Permit me to make, therefore, a few remarks on each.

As for *paper*, I fear it is a miserable misnomer in the majority of cases. Blanched to a maximum with chlorine or its combinations, the best ink soon becomes *brown*, and finally vanishes, if the *paper* does not indeed in the interim fall to pieces.

We have Perry's, Stephens's, Brande's and other inks; ink from iron, and ink from manganese,—black ink and blue ink, and India rubber fluid, to facilitate its flow. These surely may well suffice.

In the matter of pens, we have swan quills, goose quills, and crow quills, steel pens, composition pens, *et hoc genus omne*. Then there are *ruby* tipped, and *rodium* tipped, and *platinum* tipped pens. These three are superlatively excellent. I have used them with ease and pleasure, and a good pen is certainly a luxury. The latter trio, however, are too costly for my means—a *guinea each*, though perhaps from their duration, they may be equally economical in the end.

It is sufficiently clear therefore that in the articles of pen and ink there is no lack of variety. But the diminished blackness of the ink has often been charged on the ink itself, when the blame was entirely attributable to the paper, and the means used for blanching it; varied ink inventors cannot mend the matter, because the ink is faultless here. Two evils generally are concomitants in the composition of modern ink, arising from *sulphate of copper* and *bichloride of mercury* being employed as ingredients—the latter recommended as a preservation from mould—the *hygrocrocis atramenti*, by Professor Brande, no mean authority, though a recommendation of the most dangerous description. It is granted that the ink would be preserved, but school boys may be *poisoned*. *Sulphate of copper*, on galvanic principles, reacts on the steel pen and the penknives, destroys the point of the former and blunts the edge of the latter, and though Van Goor's fluid may protect the steel pen, it is useless to me, who cannot write

with it, and as quills must be mended, it is impossible almost to free them entirely from some portion of ink, however small, and the keenest edge soon ceases to cut freely.

I am, Sir, your obedient servant,
J. MURRAY.

March 19, 1840.

NOTES ON VARIOUS INVENTIONS.

Sir,—In the sketch of *Wing's Rotary Hydraulic Engine*, at page 50, vol. xxxii. of your very useful Magazine, I inadvertently made the arrow point the wrong way; it points the way the water rushes out, instead of the way the wheel revolves; being a reacting wheel, the arrow ought to point the contrary way to the water's course. I am surprised there has been no description in your journal of *Whitelaw's patent Water Wheel*, mentioned with high praise in pp. 77, 79, and 416 of vol. xxxi. No hydraulic engine yet invented can produce an equal power so economically, both as regards the water and the expense in building, as the over-shot-wheel.*

At p. 255, vol. xxxii, amongst the notices is an account of a new *Over-shot Water Wheel*, which in the time of a drought is to assist to raise its own power—not the first time such an absurdity has been proposed, an absurdity whether in the time of a drought or not; and it is to drain the mine too with a patent hydraulic belt. The belt may be of a peculiar fabric and construction, but to lift water by a belt is an old invention. The wheel to raise its own power brings to my memory that when I was in America, in 1836, a young man employed on the Boston Railway, showed me a well-finished model of a windmill pump to lift water during a drought, to fill a pond, the water from which was to drive a water wheel; a plan which was actually put in practice in this county (Northumberland), many years back, but as might be expected was a failure.

In 1835, at the cities of New York and Philadelphia, very elegant *Hose-reels* were in use, each fire-engine being attended by one when on duty.

The *patent Spiral Screw Gimblet*, now getting so common in this country, is an old invention; an acquaintance of mine a millwright by trade, has one which belonged to his father, who has been dead many years; the gimlet must have been at least 50 years in this family. In 1835, in the United States of America there was no other kind of gimlet to be purchased.

Wapshire's patent Steam Laundry, mentioned in p. 253, vol. xxxii, has nothing in the description that is new; and as to the drying closet, if your readers will take the trouble to turn to Tredgold on warming and ventilating, p. 309, edition 1836, they will find both an engraving and description of a similar drying closet.

Instead of trying to improve the old system of propelling steam vessels by means of paddle wheels, Engineers and other persons who exercise their ingenuity in that branch, ought to attempt to invent a method of propelling vessels without wheels above the surface of the water, which would abolish that great drawback to the speed of a vessel, particularly in high winds, the unsightly paddle boxes. *Ericsson's vertical shaft with Paddles*, working at the stern of the vessel, is a simple and ingenious contrivance, but from all the accounts I have met with, as great a speed cannot be obtained by it as with the old paddle-wheels.

Yours faithfully,
ARTHUR TREVELYAN.

Wallington, March 17, 1840.

THE PIRACIES OF MR. HUTCHISON, AND THE CONDUCT OF THE LONDON GAS COMPANY.

Sir,—I must reserve for a future occasion the inferences to be deduced from Mr. M'Rae's account of the origin of the statements signed "Clovis." From his explanation I learn that Mr. Hutchison was himself the real author of these statements, and Mr. M'Rae merely a literary friend, whom he gave up as the author when threatened with an action! Mr. M'Rae's disclosure has not altered, either for the better or for the worse, my opinion of Mr. Hutchison! Nor do I find in the following remarks contained in his letter, any reason to speak differently from what I have done of the London Gas Company.

* *We hope shortly to be able to publish engravings and descriptions of Mr. Whitelaw's Water-mill. The reports already published of the working of this mill disprove our correspondent's assertion.*—ED. M. M.

"Mr. Bacon asserts that the letters of 'Clovis' have been traced to the defendants in the cause,—viz., the London Gas Company. Now, Sir, it can be attested upon oath, that neither the Chairman nor Directors of the London Gas Company are implicated in this affair; as neither directly nor indirectly, nor in any shape or manner have these gentlemen interfered with, sanctioned or authorised the writing or publication of the letters in question."

A needless appeal to the most sacred of all sanctions is at all times to be deprecated, still more so when a plain and manly disclaimer from the proper quarter is at once adequate and indispensable. I admit, Sir, that the misconduct of their officers cannot attach a moral stigma to all the members of public body. But it imposes upon the whole body the *onus* of exculpation. And if they shrink from that duty, if they do not separate themselves from the offence, they become as culpable as the first offender! The highest nobleman of the land would be irretrievably disgraced by an act of perfidy or meanness, perpetrated even against his commands, in the furtherance of his interests, by the very humblest menial in his service, were he on detection of the offence to withhold or delay, apology, redress, and repudiation!

Why then should an appeal be made to me for the exculpation of the chairman and directors of this company? Their vindication is in their own hands and not in mine! Have they ever publicly reprobated the false and fabricated statements of these letters, which Mr. Hutchison has published on the subject *of their interests*, and which have at least been distinctly traced home to their real author, who is at once the patentee, their engineer, and a member of their own company? They have *not* done so! But on the contrary, they have brought an action and treated as a *lib l upon themselves* the very letter which contains my charges against that individual, though every charge I therein advanced is *now* unanswerably established, and seriously aggravated by Mr. M'Rae's disclosure! The chairman and directors may have been ignorant (I presume they have been so) of the means by which the prospects of their enterprise have in many instances been promoted. But is this any answer or excuse to those who find that, in contending with this company, they have to cope with a system of deceit, from which I am willing to believe that every one of its directors would shrink in the management of his own personal affairs? It has been asserted that I have impeached the character of the chairman and directors. There is no justice in the charge. *I hold them accountable on the very opposite ground*, that of having invested (perhaps unconsciously) with the power of *their* capital and the *influence of their character*, the piratical infringer of my patent rights. And am I to be told, that, they have done me no wrong, if I can show, that I have thereby been incessantly exposed to arts and subterfuges, by which *I* am a sufferer, and by which *they* may daily and hourly be gaining the most unjust advantages! I will select one single example at random out of several of which I am possessed, and I beg respectfully, yet fairly, to request these individuals to deduce from this one instance their own dispassionate conclusion.

I have already stated in my first letter that I was obliged, in the Court of Chancery, to institute two suits; one against the company, and another against their manufacturers, for an account of the profits they had derived from the sale and use of Mr. Hutchison's burner, which I consider to be an infringement of my patent. The manufacturers put in an answer on oath, in which they stated that they made this burner for the company only; and the company, in their answer, distinctly asserted, that they had not disposed of any of these burners except to their customers they supplied with gas, to whom they had sold them without any profit. So thoroughly was my solicitor convinced of the truth of this statement, by the combined testimony of the two answers confirmed by the assurance of the defendants' solicitor, that he thought it but just, formally, to admit that fact in the two suits. The effect of this admission would have been to exclude me from *all relief against any other parties than the company and their customers.* The statement in question has recently been *used also for another purpose!*

I have lately brought an action against these manufacturers, and my solicitor gave a retainer to the present solicitor-general, when he found that his services were claimed, under a prior *general* retainer given by the company, on the ground that the manufacturers had confined their sales to that body, who were, therefore, the parties substantially interested in the suit. Now, Sir, I have discovered, and have the means of proving by the very clearest evidence, that this assertion —that these burners have been sold to none but the customers of the London Gas Company—an assertion used, in the first instance, *to deprive me of a fair account*, and now used as a means of *wresting from me the services of my counsel*—is a gross misrepresentation, and that these burners have been offered for sale in quarters where the *London Gas Company have no interest whatever.* I may select as an example, a town within a very short distance of London. Who is the

engineer of the gas works?—A near relative of Mr. Hutchison! Who is the proprietor? —Mr. Hutchison himself!

If I may presume to express an opinion, I should acquit both the directors and their solicitors of all personal knowledge of this transaction. But I may remark, at the same time, that it forms, *for that very reason*, a more forcible illustration of the justice of my previous observations, and of the grounds on which I hold them amenable to myself, to the community at large, and to the public body, whose interests and character they represent.

HUGH FORD BACON.

2th March, 1840.

RECENT AMERICAN PATENTS.

[Selected from the *Franklin Journal* for December.]

MACHINE FOR PUNCHING AND FORMING THE EYES OF AXES, HATCHETS, &c., *Elisha K. Root, Connecticut.*—The patentee states his object to be, "to cut, punch and form in solid iron, at a single heat, or with great dispatch and accuracy, the eyes of axes and hatchets of various forms, whereby an important saving is made in the iron, coal, and labour, and the axe and hatchet eyes are rendered more perfect and uniform."

"The peculiar feature of my invention consists in using two punches, or chisels, at the same time, to punch the same axe or hatchet eye, instead one, and in punching by the force of pressure instead of by the force of blows struck by hammers, weights, or the like. The combined action of the two punches compresses the heated iron less, and divides it more exactly and equally into opposite cheeks than is practicable with one punch, and leaves a better shaped eye to finish on the eye pin."

"What I claim as my invention in the machine herein described, is the arrangement whereby a pair of punches, or chisels, are made to operate simultaneously on the opposite sides of the iron, so as to meet each other in the body thereof; and this I claim, whether the punches, or chisels, be driven by means of cams, levers, and punching slides, in the manner described, or in any other way producing the same effect by analogous means."

IMPROVEMENT IN THE MANUFACTURE OF CARPETING AND RUGS, *John Humphries, New York.*—The claim made is to "the attaching to the back or bottom of carpeting and rugs, known and designated by the names of Brussels, Brussels back, Wilton, royal Wilton, Saxony, embossed imperial, and imperial, made with any material whatever, an additional ply, rib, knit substance, or body of material of warp and weft, as described." The additional ply is represented as a very stout thread, or cord, which is laid transversely upon the bottom of the carpet, and is secured to it by means of threads passing alternately over and under the respective strands in the weaving; the additional ply stretches along in straight lines, not being in any degree drawn into the body of the carpet.*

IMPROVEMENT IN THE MODE OF SMELTING IRON ORES, *Joseph Richards, Philadelphia.*—In smelting iron ores, the object is to produce a carbonate of iron; the process hitherto known as best adapted to this end is by using charcoal for the fuel, and limestone for the flux. The substitution of coke for the fuel, or any of the mineral coals, does not produce iron so highly carbonated as that which is smelted by the use of charcoal.

My improvement consists in the use of one, or more iron cylinders, or other vessels conveniently placed, and similar to the apparatus in common use for producing pyroligneous acid, and capable of containing compactly, half a cord of wood, or any other desired quantity; dry wood evolves more acid than green, and white oak is the best.—Vinegar, or acetic acid, may be used instead of wood, and the cylinder, or vessels, may be adapted to these substances.

The cylinders or vessels containing the wood or acids must be tightly closed, and furnished with a pipe that will conduct the gas evolved into a furnace above the blast. The cylinder or vessel must then be heated to a temperature that will disengage the gas, and drive it into the furnace. The gas from half a cord of dry white oak will continue to evolve for twenty-four hours. The use of clay, as commonly practiced, will hinder the gas from escaping out of the furnace, and it will be rapidly absorbed by the metal in the fusion, and cause it to have an increased affinity for the carbon evolved from the fuel and limestone, and the iron will be thus furnished with a full charge of carbon.

In converting iron into steel, the present process is by the slow operation of the carbon, which is disengaged from the charcoal, and is absorbed by the metal bars. My improvement consists in the direct use, application, or introduction of pyroligneous, or acetic acid, in the gaseous state, into the steel furnace, in manner as aforesaid, which will cause the iron to have an increased affinity fot the carbon evolved from the fuel, and which will thus become more rapidly

* Patented also in England, by Mr. Humphries, August 1, 1839.

d with the carbon; my improvement found to be most useful when coke, l coal, or fuel other than charcoal, d in the steel furnace.

at I claim as my invention and disco- and desire to secure by letters patent, direct use, application, or introduction, oligneous or acetic acids, in a gaseous into the process of smelting iron ores, the manufacturing of steel.

JOSEPH RICHARDS.

arks by the Editor.—We apprehend e above patent has been obtained upon etical conclusions, and not after prac- rial. The patentee is a skilful manu- r of white lead, and he seems to have ded that the vapour of vinegar, or neous acid will act upon the ores of their reduction, and upon steel in ation, as it acts upon the oxide of t the very moderate temperature at that oxide is carbonated. We believe, er, that the fair deduction from what wn of chemical affinities relating to atter, would be that the vaporous or s acid would not be absorbed by the metal, or in any way contribute to bonization. The experiment, how- s one of no great difficulty, but we aware that it has been made.

ROVEMENT IN THE BOILERS OF LO- IVE AND OTHER STEAM ENGINES, *Perkins, now residing in the city of* n.—In this boiler there is to be a large r of tubes, which pass through its , and extend down into the fire cham- d up into the water of the boiler; ubes are each to contain a quantity of or other fluid (water being preferred), ey are to be hermetically sealed, so e water contained in them cannot but will be converted into surcharged the heat from which is to be conveyed om to the water within the boiler. antity of water in the tubes is to vary e density required of the steam that is roduced. "For steam and other boilers atmospheric pressure, the quantity of to be applied in each tube is to be he one thousand eight hundredth part capacity of the tubes; for a pressure of mospheres, two one thousand eight dth parts, and so on for greater or grees of pressure, by which means the will, when the boiler is at work, be ed with steam, and any additional hich is applied will rise quickly to the part of the tubes, and be given off to rounding water." "What I claim as vention is the combining a series of tubes, having quantities of water , which, in being heated, is expanded, and becomes the means of conducting any additional heat, which may be given off by the furnace to the water in the boiler, according to the principles above described."

APPARATUS FOR EXTINGUISHING SPARKS AND ARRESTING CINDERS IN THE CHIMNEYS OF LOCOMOTIVES, *John Finlay.*—A wheel like a ventilator is fixed near to the rear of the smoke box, and occupies the part leading from it to the chimney. This wheel is placed upon a horizontal axis, and the edges of its vanes are to dip into a trough of water, which by the rapid revolution of the wheel is to be thrown into spray, which is to produce the effect of extinguishing and arresting the sparks. The shaft projects through the back of the smoke box, and is driven by any suitable means.

APPARATUS FOR CONDENSING STEAM AND HEATING AIR, *Asahel Collins, New York.*—This patent is taken for an apparatus for condensing steam by means of atmospheric air, and of applying the air after being heated, to the purpose of feeding the fire. There is a double drum, or case, divided into two compartments by a diaphragm, or partition; a shaft passes through the centre of this double drum, and carries two sets of vanes, one in each compartment of the drum. Into one of these compartments steam is to be admitted for the purpose of being condensed, and into the other atmospheric air; both the steam and air are to be forced out by the fans through a tangential pipe, within which, by their commingling, the steam is to be condensed and the air heated; from this pipe the air and water pass into a common receptacle, from which the water is to be conducted by one tube to supply the boiler, and the air through another tube to the furnace, to keep up the combustion.

The condensing by atmospheric air is not claimed, but the claim is to "the condensing of steam by atmospheric air by means of a revolving fan, and the heated air thus produced used as a supporter of combustion; and the application of the mercurial gauge as a regulator of combustion; these severally produced by the manner before described, or in any other mode or manner substantially the same."

The mercurial gauge, mentioned in the claim, is intended to operate so as to act upon the ash pit door, or upon a valve, to regulate the heat, but the particular method of doing this is not described, or represented in the drawings.

The whole arrangement, taken in connexion with the description, appears to be crude and undigested, and does not offer any thing likely to be of practical utility; and

we are well assured that it would not, in its present form, have been made the subject of a patent, had it been essayed practically before making the application for one.

Machine for throwing Balls, Shot, &c., *Robert McCarty, New York.*—This machine is described as a metallic, cylindrical case, about one and a fourth inch deep, and three feet in diameter, in its interior. It is to be placed, either horizontally or vertically, on a suitable stand, which will admit of its direction being changed. A hollow shaft carries a revolving arm, or arms, within this case, and the balls are to be dropped in through a funnel, or hopper, in the centre, whence they are carried round spirally by the revolving arms, and are delivered at the periphery of the drum through a tube intended to give them a proper direction. The claims made, are to "the throwing of balls, shot, &c., by the combined action of centrifugal and projectile forces, as set forth, without reference to the particular form of the propelling arms, or face plate, by which the same are projected."

The arms are, of course, to be made to revolve with great velocity, as the velocity of the ball must be determined by that of the end of the arm. We are decidedly of opinion, that this machine will utterly disappoint the sanguine anticipations of its projector and of many others, who, upon witnessing the partial trials made with it, have deemed it a very important invention, and have entertained an idea that a continued stream of balls may be thrown by it with the utmost facility. It belongs, however, only to those who are incapable of applying the proper analysis to arrive at such a conclusion. The throwing by centrifugal force, like the throwing by any other force, will require the application of all the power necessary to give the proper momentum to the masses of matter to be thrown, and may be made the subject of direct calculation; and we are assured that such calculation would result in a direct proof of the inadequacy of this apparatus, under any conditions which could be practically applied. What is intended by "the combined action of centrifugal and projectile forces," as applied to this machine, we do not understand.

Were there no radical objection of this kind, we think that it would still be very difficult to point out the situation in which such a machine could be advantageously employed; in our own country it would, most certainly, be impossible so to do.

Improved Apparatus for Evaporating Saccharine and other Liquids, *Samuel F. Harrison.*—This apparatus consists of a number of boxes, or cases, which may be made of copper, and into which steam is to be admitted through suitable tubes. These boxes are shallow, but of considerable horizontal, or nearly horizontal, surface. Their upper sides are to be fluted, or corrugated, to cause any liquid passing over them to be retarded in its passage. They are placed with the inclination necessary for the descent of a fluid from one end of the box to the other. There may be any desired number of such boxes acting in succession, high steam being admitted into the first, and said steam being successively conducted into the others.

Metallic Frames for Neck Stocks, and Cravat Stiffeners, *John Johnson, New York, December* 31.*—These stiffeners are made of wire, which is so bent as to spring outwards around the edges of the stock; the contrivance appears to be peculiarly well adapted for stocks intended for wear in summer. The claim is to the manner of making such frames, as described and represented.

BOSTON CHARITABLE MECHANIC ASSOCIATION.

We have just seen the catalogue of the second exhibition of this association, and the report of its managers. The city of Boston, Massachusetts, has a population of about 100,000. Of this population 1,196 contributed articles for the exhibition, and in twelve days 70,000 persons visited it. This is certainly "going a-head." We extract from the catalogue, notices of a few inventions rewarded by the association.

J. Batchelder, *Saco, Me.* Dynometer. —This machine, for weighing or measuring the power consumed by any machine when in operation, is applicable whenever the power can be made to pass from one revolving shaft to another, by the intervention of cogged wheels.

The principle of construction in this very ingenious and scientific contrivance, is based upon that of the common steelyard. A beveled wheel is made to turn and bear where the fulcrum of the common beam is placed. The pivot, or fulcrum, is at the end of the bearer, opposite to that which is graduated, and coincides with the centres of two axles, which carry the two opposite beveled wheels of the machine. It should be noticed, that an allowance for the friction of the apparatus, of about three pounds for the first five

* Patented in England by Mr. Hughes, Nov. 7, 1837.

ower, changing this ratio a little as
l is increased, should be made when
ng the resistance of any machine.
eadily be perceived that the ball of
lyard must have twice the weight of
commonly used, or the reading must
led to give a correct result.
ach of the axles which carry the pro-
and propelled beveled wheels of the
is, is fixed a pulley; each pulley
a common diameter, and a loose pul-
s side to receive the belt when a dis-
ent is required.
e propelling axle is attached a clock,
the observer, who must be provided
atch, to mark the number of revolu-
any given time; and thereby to cal-
e velocity of the belt, the diameter
ulley being known.
elocity being found, and the power
d by the steelyard at the same time
nown, the number of pounds the
ould raise one foot high in a minute,
omputed by multiplying one into the

committee would suggest to Mr.
ler, whether a spiral spring steel-
uch as is in use for the safety valves
notives,) at the end of his steelyard,
ot be a more convenient method,
shifting weight on the beam; as the
and least power consumed might be
ed at a glance.
appeared to the committee another
tum, by which the Dynometer would
n made more satisfactory to them,
have been applied; that is, a con-
for equalising the intermitted power
achine, when doing certain kinds of
Perhaps a remedy would have been,
duce a balance wheel between the
ter and the machine under trial,
ould tend to prevent the vibrating of
lyard, which was so apparent at the
on; notwithstanding this, its indica-
the passing power was very satis-

truly a simple, effectual, and scientific
nce. *A Silver Medal.*

DSON AND PARKS, *Springfield.*—
mere Shearing Machine. It was
l in 1834, and has since had several
ments made in it. It is calculated
s of the finest fabric, and we were
t it would shear from ten to twelve
r minute, doing its work with the
nicety and certainty of not cutting,
y carelessness knots in the cloth are
which case this machine, like all
e judges are are acquainted with,
robably injure the cloth more or less.
reat beauty of this invention consists in the method adopted for sharpening the spiral knives and blades, by making one grind the other, thereby ensuring a perfect contact of the cutting edges, at the same time saving other expensive apparatus for effecting the same end. The grinding is performed once in every three or four days, requiring only to be honed occasionally during the interval by the hand. A machine runs about four years without repairs, except the grinding of the blades. If we make (for comparison) the *old hand shears*, which forty years ago were solely used, our zero or comparative standard, this machine will stand No. 200 on the scale; for it will do the work of 200 men using the old shears; and if there can be produced a machine to exceed this number on the scale, the committee will be ready and happy to succumb, and give up their opinion that it ought to receive a liberal reward.

It is true many machines fitted with spiral cutters, have been in use for some time past; but the application of twenty spiral cutters, all working with the utmost precision against an inflexible and truly ground knife edge, susceptible of being ground in their place in the machine, is, we consider, a great improvement.

There is another consideration entitled to be noticed, viz., that this invention, or improvement, was first introduced and liberally encouraged by one of our most respectable and well managed woollen manufactories, the Middlesex Company at Lowell. *A Gold Medal.*

MISSES JUDKINS, *Portland.*—Lace Loom. This machine we cannot better describe than in the language of the friend to whom we have before been obliged, and who has the peculiar tact of saying much in very few words.

The Misses Judkins, of Portland, have offered one of the most interesting articles at the Fair. It is a little bit of a machine, invented by them, of a cheap and simple construction, for the purpose of "making friges, scarfs, insertions, and a great variety of other useful articles, which can be made in any family." When ladies turn inventors of machinery, and introduce new and beautiful manufactures, it is time for the men to take off their hats and make a low bow, both in respect for the fair constructors, and in gratitude for the spread of Yankee ingenuity. The machine here spoken of is very small, neat and simple, is easily used, and produces a great variety of beautiful ornamental work, of woollen, silk, thread, or fine braid. All the kinds of work for scarfs, bags, purses, &c., in the style of netting, are very handsome, and neatly executed. Watch-guards,

insertings, and edgings, borders in the style of coach lace, and fancy binding for children's clothes, are also made in good taste, and with extraordinary strength and durability. This instrument has pleased us more than many of mightier show and pretensions, for it will prove a valuable adjunct to domestic industry and prosperity. Many an hour that might be badly spent or idly wasted, could be occupied by our young ladies in manufacturing beautiful and useful articles for good service, or ornaments for apparel, advantageously to themselves and their friends. The introduction of such an occupation should entitle the inventors to the gratitude of the community. *A Silver Medal.*

J. HOLDEN, *Cambridge.*—Dove-tailing Machine. This machine was invented and patented by ——— Davis, of Boston. The right is now owned by J. Holden, of Cambridge. It is a very clever contrivance for uniting the four perpendicular angles of boxes, and other articles in wood, by means of a dove-tailed tenon and groove. The construction of the joint may be imagined by first supposing the four corners of the box to be mitred to fit each other in the usual way; after which it may be supposed a dove-tailed tongue is ploughed on the face of the mitre of one of the sides, from the top to the bottom of the box; it may be supposed, again, that a corresponding dove-tailed groove is ploughed on the other face of the mitred joint, and the tongue when shoved down the groove will unite firmly the two sides of the box without nails, glue, or any other foreign aid, in their true positions; the other three corners being joined in the same manner, a box ready for the top and bottom will be formed. The top and bottom cannot be made by the machine, for it pretends to nothing more than to unite permanently the four perpendicular corners, which work it performs with amazing celerity and accuracy, two men being able to turn out in the unfinished state above-mentioned, three hundred candle-boxes in a day of ten hours' labour. The adjustments for different sized dove-tails can be made with very little loss of time.

The machine is upon the whole extremely simple, considering the complexity of the work it performs, it having only three circular saws for small dove-tails, and four saws for larger work. The work is confined to a carriage, and shoves forward by the hand against the saws in succession; the first cutting off the board to a mitre, the second saws in one side of the groove or tongue, the third the other side, and the fourth, if it is to be used, enlarges the groove to the requisite width. We consider this contrivance highly worthy the notice of the society. *A Silver Medal.*

J. BABBETT, *Boston.* Railroad Boxes.—This is a composition box, lined with a soft metal, principally pure tin; a small projection or flange prevents the soft metal being crowded out of the box. The object is to prevent the journal from heating, which it is very liable to do when moving with high velocities; and it is equally calculated for mill-shafts or steam-boat journals. One set has been in use on the Worcester Railroad for a number of weeks, and so far has realised the most sanguine wishes of the inventor. From our own experience, and reasoning from analogy, we have no doubt of its entire success. We think Mr. Babbett is entitled to the thanks of the community for this, as well as for many other highly ingenious and scientific improvements in the arts.

A Silver Medal.

G. T. GILBERT, *Lodi, N. Y.* Rotary Shingle Machine.—A cast-iron circular plate, about eight feet in diameter, with the rim a little thicker than the centre, in order to add to its weight that it might operate as a fly-wheel. In this plate, about one-third from its centre, were two slots or openings; at these openings were fixed two stout knives or cutters, placed at such angles as to cut the thick and thin end of the shingle alternately as the plate revolved. This wheel or plate was vertical; an axis passed through its centre; on the end of this was a fast and loose pulley, and a belt passing from this to the moving power. The blocks of wood were prepared by being cut off at the common length of shingles, were then steamed, and while flexible from the steam were held in contact with the cast-iron plate, which at every revolution cut or sliced off two shingles. We saw it in operation, when it was making one hundred and twenty revolutions per minute; consequently making two hundred and forty shingles in the same time.

The shingles had a very smooth surface, and in this respect were better than those which were sawed; and appeared in every respect as good as any we ever saw. The great difficulty, it appears to your committee, is to have cutters which will stand when they come in contact with hard pine knots. Experience will show if this difficulty is a serious one. The proprietor averred it had not been found to be so. Should there be no practical objection of this kind, it will supersede all others, as there is no waste of stuff. Half a dozen of them will supply the whole country. *A Silver Medal.*

HE SIZE OF VESSELS ADAPTED TO NAVIGATION, AS DEDUCED FROM THE CORRECT PRINCIPLE OF THE CONSTRUCTION OF THE ARK.

[*From the Con truction of the Ark and Steam Navigation to India.*]

irst great point in which we have not ied out our knowledge to the exten- ctice of practical navigation is size; e we have to look forward to im- ents of very great extent, in our navigation, from increase of size

auses which give the advantages to vessel are manifold; and admitting double the dimensions of a ship, her twice as long as before, that very ial length instead of having increased stance of the water in a correspond- ree to its velocity, has actually dimi- proportionally that resistance, and to a degree, as to have counterbalanced ier that part of resistance, arising icreased breadth; for the capacity, nd accommodation of a ship increase atio of the cube of her linear dimen- vhile her sectional area, which gives stance, increases only as the square. ill, therefore, be obvious, that the he ship, the less proportionate power onnage is required to propel it, for it borne in mind, that the resistance a experiences, in going through the is proportionate not merely to the of the absolute velocity of the vessel the water, but to the square of the velocity with which it is thrown nd which is diminished in proportion ength is increased; and furthermore, waves, or swell, caused by the back- of the paddle-wheels, are rather an ge than otherwise, as may be fre- seen gathering up and following a en when going against a "head sea," a favourable gale materially assist in ing her.

resistance, therefore, to a larger ves- ies only from the increased quantity displaced by the increased section through the water; so that in en- the dimensions of a vessel, eight he capacity of tonnage of another, it ly require for the same, or even rather velocity, four times the mechanical giving a saving of one-half, as regards er, consumption of coal, and capacity ing goods.

regard to the structure of steam , experience will shew that both the e and run cannot be too fine; and the two, the run should be fuller e entrance, being just the reverse of d velocity system. Here, length is larly applicable, as allowing so much for the entrance and run, and still ing great space for the dead flats, *dmits of so much capacity for carrying.* *sel thus constructed,* will be easier, safer, and drier, than one after the old fashion.

The waves which strike a large vessel are not greater in size than those which strike a small one, proportionally they are much less so; for any person may easily convince him-self that the motion of the waves is not ne-cessarily accompanied with a current of water in the same direction, by throwing any light substance into the sea a little beyond the breakers, or into a piece of standing water the surface of which is ruffled; he will see that such a floating body rises and falls with the motion of the waves, but does not per-ceptibly move towards the shore; this may also be assimilated to a high standing field of ripe corn, when the wind blows it to and fro, and yet it becomes erect as soon as the wind has ceased.

Thus, the larger vessel is safer, surer, sails better to time, is drier, easier in the sea, and in every way preferable to the smaller one.

The successful voyages made by the *Great Western*—differing as that noble vessel does in so many important respects, especially size, tonnage, and consumption of fuel,—completely overturn the strange doctrine which, it may be recollected, Dr Lardner, laid down, of the impossibility of a vessel steaming across the Atlantic, without taking in at some intermediate station a second supply of fuel, while it was proved by the *Great Western* arriving only a few hours after the *Sirius*, which had five days the start of her from Cork, that had the course been a few hundred miles longer, she would most certainly have overtaken her.

Here is another proof what size will do, when systematically and proportionably worked together.

Under these considerations, after attaining the very best proportion and form of the parts, the important matter is size; the smaller the vessel with a proportionate pro-pelling power, the smaller is the rate of speed even in smooth water, just as a long-legged animal gets on faster than a short-legged one.

But on rough water, the retarding friction increases with compound proportion, while the very distance itself is increased to the small vessel which has to pass up and down the opposite slope of the waves in an undu-lating course, whereas on the contrary, the large vessel goes directly through it.

If a vessel were constructed so large (as the Ark for example) that the largest waves of the ocean bore the same proportion to her that the ripples of a calm do to a small vessel then a speed may be obtained on the ocean, possibly equal to that, at present usual on our railways; and the evil of sea-sickness,

so fearful an affliction on passengers, would be almost entirely removed; for great length enables these Leviathans to compass three or four waves at a time, in a stiff gale, and even in a hurricane, at least the tail of one, and the head of another wave, which keeps out of the trough of any undulating sea, so fearful at times to the short-beamed vessels of the present day.

In opposition to this new system in length of ships, many of the old school are continually asserting that they must break their backs, that they are certain of being hogged, &c. &c., with other alarming forebodings, taking up this doctrine one from the other, without giving any scientific reason or standard rule to elucidate their given and received notions and impressions. Now it would really be at least kind, and even patriotic, if these learned professors would inform us "why has not the *Great Western* broken her back?"

Amongst many advantages in size, and consequently in speed of vessels of increased burthen, there are many fruitful sources of economy in expenditure, being far more important than economy in outlay. A larger number of passengers can be carried at a far cheaper rate than a small number, and steam can also be used with a less proportionate waste in large vessels than it can in small ones; besides this, there is a saving of time involving a great and expensive table and maintenance, with much wear and tear.

A passenger would much rather pay his thirty pounds down to traverse the same distance in ten, than in thirty days; and as the actual *maximum* speed for ocean steamers is as yet far from being ascertained, owing to the expense attending experiments on a large scale, we cannot yet assign a limit:—one thing, however, has been satisfactorily shown, that the largest vessels have always proved the swiftest, and this seems to indicate the principle which has yet to be worked out, for there are several steamers in England which have reached a speed of fourteen and even fifteen miles an hour. The *Great Western* took but seventy-two minutes in going from London to Gravesend, a distance of twenty-two miles, being at the rate of eighteen and a half miles per hour; and deducting four and a half miles for tide, her rate was fourteen miles per hour. This can be proved, is well authenticated, and may be found in the log of the vessel.

At the account of the speed of some of the American boats we shall cease to wonder, when we learn the enormous power by which they are propelled. According to Mr. Stevenson, some of them are provided with nine hundred horse-power, or more than twice the power of the *Great Western*, in vessels scarcely one-fourth of her size; but then, these are river-craft, and have no seas to contend against. At present their rate of going is as strange to us, as the slow-moving packet-boats and barges drawn by horses. And we may reasonably hope, that ere long, as great a revolution will be made in marine travelling, as has been effected on railways; for it is difficult, and even totally impossible to assign a maximum rate, at which a vessel may be propelled by steam, when we consider the extraordinary and unaccountable speed at which whales are known to move through the waters.

The *Great Western* passes and re-passes the Atlantic Ocean, a distance of three thousand miles, with the precision and safety of a mail-coach: and all this vast power depends, in a great measure, on the building-yards, mines, and workshops of England, which are thus in a wonderful manner made the means of diffusing Literature, Arts, Commerce, Civilization, and Christianity, thoughout the whole world; for certainly no system ever became so popular so suddenly, and so widely diffused.

LIST OF DESIGNS REGISTERED BETWEEN 27TH FEBRUARY AND 25TH MARCH, 1840.

Date of Registration.	Number on the Register.	Registered Proprietor's Name.	Subject of Design.	Time for which the protection is granted.
Feb. 28.	267	G. H. Bursill	Letter balance	3 years
"	268	Wilcoxon and Sons	Stained paper	1
March 2.	269	G. A. and D. Ford	Painted and Japanned baise	1
3.	270	Broadhead and Atkin	Tea-pot	3
5.	271	W. Rohn	Wooden-paving block	1
"	272	Rd. Graham.	Thrashing machine drum	3
"	273,4	J. Ridgway	Jug	1
"	275	Summers and Smith	Embossed paper	1
6.	276	T. Baines	Stock	1
"	277	G. H. Bursill	Letter balance	1
9.	278	T. Hughes	Embossed cloth	1
"	279	J. Gold	Glass dish	1
12.	280	J. Yates	Fender	3
16.	281	J. and J. McRae	Letter balance	3
23.	282	J. Yates	Stove	3
25.	283	W. Potts	Curtain band	3

)F SCOTCH PATENTS GRANTED VEEN THE 22ND FEBRUARY AND D MARCH, 1840.

Beaumont Neilson, of Glasgow, gentleman, n improved methods of coating iron under rcumstances, to prevent oxidation or cor- id for other purposes. Sealed 25th Feb.; ths to specify.

Pontifex, of Shoe-lane, London, for an ient in treating fluids containing colouring obtain the colouring matter therefrom.

Oram, of 27, East-street, Red Lion- Middlesex, gent., for improvements in the ure of fuel. March 5.

Forrester, residing at Barhead, Renfrew, at Levern Mill, for certain improvements starching, dressing and otherwise prepar- for weaving fabrics, and in the machinery ratus therewith connected. March 6.

urn Smith, of Salford, Manchester, Lan- tton spinner, for certain improvements in for preparing, roving, spinning and cotton and other fibrous substances.

:e Wood Fletcher, of Chorlton-upon- Manchester, Lancaster, machinist, for ement or improvements in the manufac- oollen and other cloths, or fabrics, and in ation of such cloths or fabrics to various rposes. March 14.

Schofield, of Littleborough, Lancaster, nner and fustian manufacturer, and Ed- ch, of Littleborough aforesaid, manager pinners and weavers, for certain improve- ooms for weaving various kinds of cloth.

Maltby, junior, of Mile End, chemist, and uerton, brass founder, of Percy-street, , for improvements in extracting and con- the colour, tanin, and other matters in vegetable and animal substances.

NOTES AND NOTICES.

ncock's Steam Carriage.—One of the first science seems now-a-days to be, to carry he great principle of locomotion. From sprung our several railroads, by means of r Majesty's liege subjects are whisked one given point to another, at the rate venty or thirty miles an hour. Certain persons have exercised their faculties view of ascertaining how far steam en- h carriages attached, can be made to the common turnpike roads effectively. he most conspicuous in their endeavours pect we may mention Mr. Hancock, who mployed in this work for the last fifteen we are bound to say, from what we have that his labours have not been in vain. been led to these remarks from having senger in Mr. Hancock's steam carriage which proceeded from Finsbury-square in a manner that left no doubt upon our the public would derive considerable by the establishment of such a mode of ation as a species of competition between ng lines of railroads. Mr. Hancock's iage, which, by the way, was filled with f great scientific knowledge, amongst noticed Sir James Gardiner and others in the success of the experiment—is in nd is immediately connected with, the which it is propelled. The centre of the occupied by the guide, who can at will, of an instrument attached to the head of e, and which operates upon the engine, etard the progress of the vehicle. He through the medium of a sort of rudder, works in manner similar to that adopted sman on board a vessel, regulate the *of the steam carriage*, with a correct- ness that might rival the most expert London Jehu. Mr. Hancock officiated as guide on this oc- casion, and it was wonderful to see the ease with which he effected all the necessary movements. Stage coaches, cabs, and omnibuses were passed with astonishing precision, and an assurance was thus given to the passengers that there was all the security of the old style of travelling, while there was a vast improvement in reference to speed. This leads us to observe that the distance from town to Barnet, about 12 miles, was performed in an hour and five minutes, and within an hour upon the return of the carriage to Finsbury-square. There is, it would appear, another advantage to be gained by the adoption of the invention in question —it will enable persons to travel at half the price they now pay for such accommodation. We hail with pleasure any attempt to do away the monotony which at present exists along the road and the rural villages, occasioned by the establishment of rail- roads, and trust the efforts of Mr. Hancock to carry out his invention may meet with the encouragement it merits. We may mention that the Earl of Dun- donald intended to have proceeded with the passen- gers, but was prevented from doing so in conse- quence of urgent business. His lordship, however, arrived at Finsbury-square just previous to the ar- rival of the steam-carriage, and seemed to take a deep interest in the result of the intended experi- ment, which, we repeat, was perfectly successful.— *Morning Advertiser.*

Postage Stamps.—It has always been contended that beauty of design and workmanship is one of the best securities against forgery. This is at last felt even by the directors of the Bank of England, and a new bank note is in preparation, from a de- sign by Richard Westmacott, to be engraved by J. H. Robinson, and is expected to contain every beauty which art is capable of giving to it. What will be in this respect the character of the postage stamps, may be inferred from the artists who are employed in the production of them. We need only mention the names of W. Mulready, W. Wyon, J. Thompson, and C. Heath. The idea of calling in the powers of art as auxiliary to the philanthropic agency of the penny-post is a happy one. Such an opportunity of spreading models of beauty over the whole face of the country (we might almost say the world,) and among all classes of the people, has never occurred before in the history of mankind. Never before has artist had so glorious a host of spectators for his efforts, and the distribution of hundreds of millions of a beautiful object can not be without its effect on the education of the public taste. The Chancellor of the Exchequer could not have selected four artists more suitable for his purpose. The designs on the die in the hands of Mr. Wyon, and on the plate in the hands of Mr. Charles Heath, have been stated to be the head of the Queen. Mr. Wyon's die is, we presume, in- tended for the letter paper, and Mr. Heath's plate for the adhesive stamp. A forgery of the work of either of these distinguished artists, to deceive (as it must do to be effectual) an experienced eye, would be a work we should very well like to behold. The mechanical execution, both in stamping and printing, will, it is fair to suppose, do justice to the performances of these artists; and such pro- cesses have of course been adopted as to ensure perfect identity in the numerous dies and plates which will be necessarily wanted. Of Mr. Mul- ready's design, which is confided to Mr. John Thompson, we can speak in the highest terms. In less than half the usual space for the face of a letter, the artist has placed groups of upwards of forty figures. In the centre is Britannia in the act of dispatching four winged messengers. The figures on each side of her are groups emblematical of British commerce, and communication with all parts of the world. On the right are East Indians on elephants, directing the embarkation of merchan- dise; next Arabs, with camels laden; next, Chinese; on the left, American Indians concluding a treaty, and negroes packing casks of sugar. The whole design occupies rather more than an inch in width

along the face of an ordinary envelope. In what may be called the foreground on the one side, a young man is reading a letter to his mother, whose clasped hands express her emotion at its contents; on the other side is a group of three figures, each one eagerly pressing around to read, or at least to catch a sight of the welcome letter. The whole conception forcibly tells its story, and suggests emotions of gratitude at the universal blessings that flow from unfettering correspondence, which is but speech by means of written characters. As a work of art, in respect of composition and characteristic portraiture, it is eminently successful. The national peculiarities of attitude and costume, though expressed by outline only, are so well preserved, that each group may be instantly recognised. The whole design is like a pen-and-ink sketch by a distinguished artist, as far removed as possible from the commonplace designs usually employed in analogous cases. And considering the small space, the mode of printing to be employed, and other circumstances necessarily fettering the artist's powers, we think that artists and the public will agree with us, that Mr. Mulready has produced the very best work of art consistent with the conditions within which by the nature of the case he was confined.—*London and Westminster Review.*

Captain Smith's Paddle Box Life Boats.—We understand that the Lords of the Admiralty have ordered her Majesty's steam ship *Medea*, to be fitted with that most useful contrivance, Captain Smith's patent paddle box boat described and figured in our 843rd number. There are also two steamers now building at Messrs. Curling and Young's yard for the Pacific Steam Navigation Company, which are also to be supplied with this means of safety for the passengers and crew.

Canal to Unite the German Ocean with the Mediterranean.—The project of the canal of the Pyrenees, to unite the German Ocean with the Mediterranean, has been discussed in the French Chamber of Deputies, as one of the greatest importance to the inhabitants of the southern departments. The general advantages of avoiding the passage through the Straights of Gibraltar, and of facilitating the communication between France and Spain, are dwelt on by the advocates for the completion of the canal, and there seems to be a feeling that the departments adjoining the Pyrenees have been too much neglected. The convenient retreat from Spain which such a canal would afford to an army is likewise brought forward. Petitions on the subject prayed a reference to the President of the Council and the Minister of Public Works, which the Chamber has decreed.

Extraordinary Viaduct.—Workmen are now engaged in the erection of one of the most extraordinary iron viaducts connected with any railway, either finished or in the course of completion, in Great Britain. The viaduct in question will cross Fairfield-street, Manchester, on the Manchester and Birmingham line of railway. The weight of the iron consumed in this viaduct is 540 tons, and it is composed of six ribs of the span of 128 feet each. The viaduct is also very remarkable for its acute angle—such angle being 24½ deg.; the width of the street being only sixteen yards, or forty-eight feet. Messrs. Bramah, of London, are the contractors.

New Alloys of Metals.—A curious and valuable discovery has just been made in the alloy of metals. A manufacturer of Paris has invented a composition much less oxidable than silver, and which will not melt at less than a heat treble that which silver will bear; the cost of it is less than 4*d.* an ounce. Another improvement is in steel; an Englishman at Brussels has discovered a mode of casting iron so that it flows from the furnace pure steel, better than the best cast-steel in England, and almost equal to that which has undergone the process of beating. The cost of this steel is only a farthing per pound greater than that of cast-iron.—*Mining Jour.*

Novel Experiment in Aerostation.—A series of experiments was privately exhibited in the lecture-room of the Polytechnic Institution, in Regent-street, on Tuesday afternoon, by Mr. Green. That celebrated aeronaut has long entertained the opinion that a balloon voyage from the continent of America to Europe may be safely and certainly effected, founded upon repeated observations on the atmosphere, which have led him to the conviction that, whatever may be the direction of the winds below, the current of air above invariably traverses from some point between the north and west. Mr. Green has kept a regular log of all his numerous voyages. To get into and remain in this current it is, however, necessary that the balloon should be kept at a certain altitude; and to show how this could be effected was one of the objects of the experiments. The machinery made use of by Mr. Green is both simple and portable, and is constructed upon a well-known pneumatic principle. It is composed of two fans, or blades of wood, attached to a spindle, which passes through the bottom of the car. The fans are of one longitudinal piece, to the centre of which the spindle is fixed, after the manner of a windmill, with but two wings or arms, and their blades present a given angle horizontally, in which direction they move. The effect was as follows:—A miniature balloon, of about three feet in diameter, was filled with common coal gas. To this were attached the hoop, netting, and car, and in the car a small piece of spring mechanism was placed to give motion to the fans. The balloon was then balanced; that is, a sufficient weight was placed in the car to keep it suspended in the air, without the capacity to rise or inclination to sink. Mr. Green then touched a stop in the mechanism, which immediately communicated a rapid rotatory motion to the fans, whereupon the machine rose steadily to the ceiling, from which it continued to rebound until the clockwork had run out. Deprived of this assistance, it immediately fell. The reverse of this experiment was then performed. The balloon was first raised into the air, and then balanced. A similar motion was imparted to the fans, the action of which in this case was, however, reversed, and the balloon was immediately pulled down to the ground by their force. A more interesting effect still was then exhibited. The balloon, with the guide-rope attached to it, was balanced as before, the guide-rope having a small brass weight fixed to the end of it. The fans were then removed from under the car and placed sideways upon it, by which their action became vertical. Upon motion being communicated, the balloon floated in a horisontal line, dragging the guide-rope after it with the weight trailing along the floor, and continued to do so until the mechanism ceased, when it immediately became stationary again. These experiments were frequently repeated with complete success. Mr. Green states that by these simple means a voyage across the Atlantic may be performed as easily as one from Vauxhall-gardens to Nassau, and he calculated that from three to four days will be sufficient for the undertaking. *Nous verrons.* The required size of the fans for his monster balloon would be about six feet in length, and the machinery by which they would be turned would be placed inside the car, to be governed at the will of the persons there. These experiments will probably be practically carried out during the summer, by what appears to us to be, under any circumstances, a most perilous undertaking.—*Times.*

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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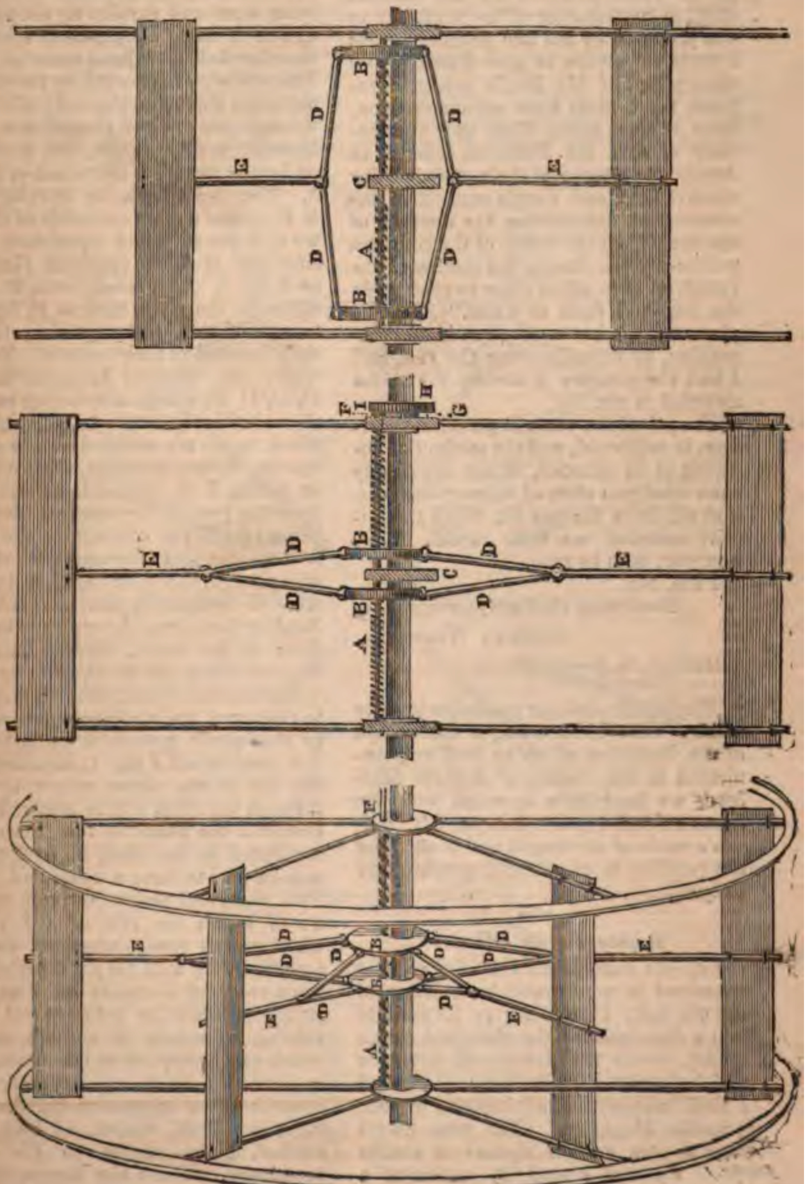
WILSON'S EXPANDING AND CONTRACTING PADDLE-WHEEL.

Fig. 2. Fig. 1. Fig. 4.



WILSON'S EXPANDING AND DIMINISHING PADDLE-WHEELS.

Sir,—My attention was directed by a friend yesterday to the paragraph in your Magazine, No. 863, page 397, as to a paddle-wheel patented by Mr. Samuel Hall, in consequence of its similarity to one proposed by me two years ago. As I perceive you are to give drawings and descriptions of Mr. Hall's patent, I refrain, till I shall have examined them, from saying more, than that the Society of Arts for Scotland, offered in August, 1827, one of their medals "for a convenient and simple method of increasing or diminishing the distance of the floats from the centre of the common paddle-wheels, during the motion of the vessel, so as to adapt them to changes in the load and draft of water." Various plans and models were given in in competition, by myself among the rest, and I had the pleasure of having the medal awarded to me.

The principle, you will perceive, therefore, is rather old, and the method of applying it in practice, is not apparently from what you state of it, very different, if at all, from the one for which the Society awarded me their medal. This, however, is to be seen.

I am, Sir,

Your most obedient, servant,

George Wilson.

Edinburgh, 75, Broughton-street, March 5, 1840.

[Having directed our publisher to write to Mr. Wilson, requesting a description of the invention which he had communicated to the *Society of Arts for Scotland*, we have been favoured with the communication which follows. Mr. Wilson's mode of drawing in and protruding the paddles is extremely ingenious and simple.]

Reefing Paddle Wheels.

Sir,—In compliance with the request contained in your publisher's letter of the 9th inst., I now beg to forward to you a description of the plan, laid with a model, before the Society of Arts, for which they awarded me their medal, and I shall be happy to see it inserted in your valuable Magazine. (The same letters apply in the several figures to similar parts.) Figures 1 and 2, represent a section of the wheel. Fig. 1 representing two of the boards at their greatest distance from the centre, and fig. 2, those boards drawn towards the centre. Fig. 4, is a perspective view.

The axle and rims are the same as in the common paddle wheels. A is a screw lying near and parallel to the axle, one half of it being a right-hand screw, and the other half a left-hand screw as shown. This screw is supported by the naves of the outer rims, and the body of it passes through one of them altogether at F, and likewise passes through, and is supported by the nave C of the wheel or rim fig. 3. The two wheels, or circular pieces B B, placed one on each side of the centre C of the axle, and equidistant therefrom, are made to approach that point as in fig. 1, or to recede from it to the naves of the outer rims as in fig. 2, by means of this screw passing through nuts inserted in their centres. To these wheels are attached by joints the rods D, D, D, D, which, converging in pairs, are united to the corresponding rods E E, which again are attached to the paddle-boards. When, therefore, the two wheels, or pieces B B, approach to or recede from the point C by means of the screw being turned the one way or the other, it is evident that corresponding changes take place in the rods attached to them, and of course in the paddle-boards. Sending them from the centre or drawing them to the centre, thereby increasing or diminishing the circle made by them.

The method by which motion is given to the screw, and thereby simultaneously to the whole system is as follows:—

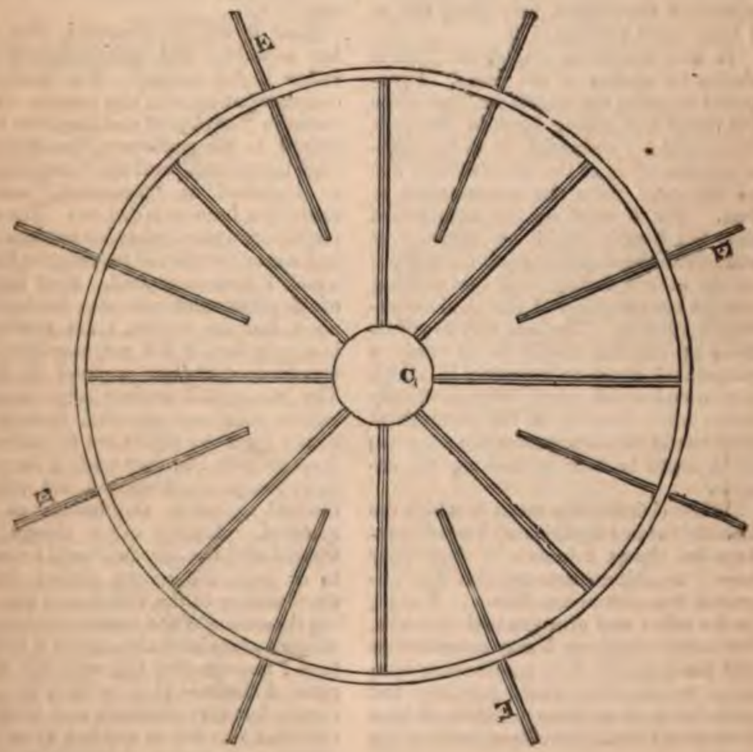
A small wheel F (fig. 1) is placed upon the end of the screw, where it passes through the nave, and is always in contact with the wheel G, this latter wheel is rivetted to the wheel H, so that these may be said to form a wheel and pinion. This wheel and pinion (through the centre of which the axle of the paddle-wheel passes freely) when not required revolves *along with the paddle-wheel*, but when required is capable of being kept stationary while the paddle-wheel is revolving by means of a catch or stop which can be applied at I, and when this is done, the wheel on the end of the screw is forced to revolve together with the screw itself, which, as before described, gives motion to the whole machinery. When the boards are adjusted the catch is disengaged, and re-

cured so as not to interfere unless when required.

Fig. 3 is a wheel, the nave C of which is represented in figs. 1 and 2, in order to show its position. Through holes in its rim the arms E E, are made to pass in order to keep them steady and in their proper places. It also answers another important object; for these arms or rods are thereby of use, not only in changing the position of the boards, but being thus supported themselves, they support the boards at the middle; for which purpose a third wheel, or rim, is generally placed there at any rate in large paddle-wheels. In fact, they answer the purpose of the centre set of radial rods at the same time that they are made to perform the important duty of adjusting the boards to their proper depth in the water.

The inner portion of the wheel round the axle might be inclosed, which would preserve the screw and joints dry, and

Fig. 3



they would be less apt to corrode. There is very little danger of derangement in the several parts of the machine, and very little inconvenience. Little trouble is required to bring it into operation, and what appears to be particularly favourable is that, *when the boards are adjusted as may be required, nothing is necessary to retain them,* the machine being perfectly inert, unless when actually put in motion.

The above is a description of the wheel given into the Society of Arts. Impressed with the importance of the introduction of paddle-wheels upon this principle into use, I wrote to the Admiralty on the subject, who requested a description to be sent, which

was done in April, 1838. It is somewhat different from the above, in order not only to adjust the boards in the water, but likewise to take them out of the water altogether, which I thought would be advantageous for government steamers and others making long voyages, as they might often proceed with sails at a sufficient speed, whereas, at present, I have no doubt the dragging of the paddles through the water forms an insuperable obstacle to rapid sailing, reducing their speed most materially. Possibly some of the engineers connected with the Admiralty may have been consulted on the subject, very likely not, as I have heard nothing of it.

It was wanted to adjust the boards *during the motion of the vessel.* I proposed to make the wheels so, that while the vessel was sailing forward the paddles could be *protruded* so as to counteract the effect of the vessels rising out of the water from the consumption of fuel. For, I went on the assumption that the boards could be adjusted at starting to the required depth consequent on the vessels lading, and that nothing but the consumption of fuel could afterwards affect it. The best way to adjust them at starting would be to apply a pinion and winch to the wheel H, which pinion and winch could be immediately taken off. That is, if the strength of men would be adequate for the purpose; or it could be done by backing the engine.

While claiming the merit to which the Society's award entitles me, I would perhaps be doing injustice to that body were I to omit mentioning, that their approval was not unconditional. I shall, as the safest way give you their remarks, but before doing so, I may premise that had the terms of their specification been more precise, they would not have had such faults of *omission* to state, at least I am sure I would have been more on my guard.

Their remarks are are as follows (Mr. Wilson's and Mr. Rose's) "*Are considered the best and most practicable,* the principle in both is nearly identical, but the method of communicating with the interior of the vessel in Mr. Wilson's *is so elegant* and simple as to entitle it *to the preference.* Although the object *in view is* attained by both of the methods, *yet* both are deficient in the means of giving the requisite strength to the rims of the paddle-wheels. It is also conceived that some method is required of making fast the floats in their new place when shifted, independent of the shifting apparatus itself, because otherwise much of the strain of the floats would come on the moving mechanism. These hints are intended to direct the attention of the ingenious inventors to the circumstance that many practical points of much importance require to be attended to, before the benefit intended can be derived from the introduction of their beautiful contrivances into common use."

Now it will be observed, that what *has been done* and before described, is rather highly praised. The method of communicating with the interior of the vessel is "*so elegant and simple as to entitle it to the preference,* the object in view is attained," and the "contrivance" is described as "beautiful," and the medal has been awarded me. The complaints are against what *has not been done,* and not to the plan of moving the boards which I have described. Now not one of the plans went one step further than mine, and the reason, I am convinced, is simply this, it was not considered necessary to *meet their proposal as stated.* The plans and models were made to answer *what was specified,* though evidently from the report not to answer all they wanted. For they wanted the wheel to be completely described, not merely a method to move the boards as they *specified.* Among other things they wanted that the boards should be moved to or from the centre, during the *onward* motion of the vessel, and not during the *motion* of the vessel simply, which allowed me to back the engine if I chose, (and I now suspect this was one of the main difficulties they wished to overcome), but they admitted that their specification was not so worded, as to make the want of this an objection to any of the plans.

As the object which induced me to address you on this subject was, that the construction of paddle-wheels on the adjusting principle was alleged to be an invention of Mr. Hall's (and that he has taken out a patent for his method), whereas the Society of Arts here proposed in 1837, such a construction of wheel, and awarded their medal for a

plan of one: I have not stated the plan otherwise than as laid before that society, that it may be seen what was then done.

If engineers or steam-boat companies were to consider the method of shifting the boards worthy of adoption, the framing of the wheel could be quite easily accomplished, and if the boards are not secure enough already, I am quite prepared to secure them further, and remove the strain entirely off the moving mechanism with very little alteration on the plan. And I would be most happy to give the benefit of my suggestions and remarks on the subject if they were thought worthy of being asked.

I am, Sir, your obedient servant,

GEORGE WILSON.

75, Broughton-street, Edinburgh,
March 14, 1840.

OXLEY'S EXPANDING AND CONTRACTING PADDLE WHEELS, ETC.

Sir,—You will allow, Sir, that however little of envy may enter into the composition of any man's mind, there is scarcely any one who, having toiled and studied in philosophical and mechanical improvements for upwards of thirty-two years without deriving any benefit therefrom, but would feel much mortification at seeing that while for want of means and friends to bring his inventions and discoveries into use, other persons who have only applied themselves to such pursuits, perhaps for a very few years, bring forward, and profit by, the very inventions which for many years he had expected would have been a great source of emolument, and have enabled him to procure a competence for old age.

It is not alone the long toiling individual that suffers, but the public also are for many years deprived of the advantages they might have long before enjoyed had encouragement and the means been afforded to the earliest inventors and discoverers. These inconveniences and disappointments are chiefly imputable to the unjust and oppressive patent laws of this United Kingdom. I can see no just reason why a patent should not be granted for 7*l*. 10*s*. to about ten pounds, as is done in the United States of North America. Had patents been procurable at the said reasonable price in this kingdom, I should have taken out more than twenty patents for my own inventions, and we should have had steam navigation 20 years ago across the Atlantic on a far superior plan to either that adopted by the *Great Western* or the *British Queen* steam ships.

Besides having invented various new plans of boilers and steam engines upwards of twenty years ago, I had also different plans of improved paddle-wheels. I have enclosed you two different ones of my own invention; for if I am to be deprived of all benefit by recent competitors, I shall certainly do my best to prevent depriving me of the honor I ought to derive from my studies and experiments in this department of science.

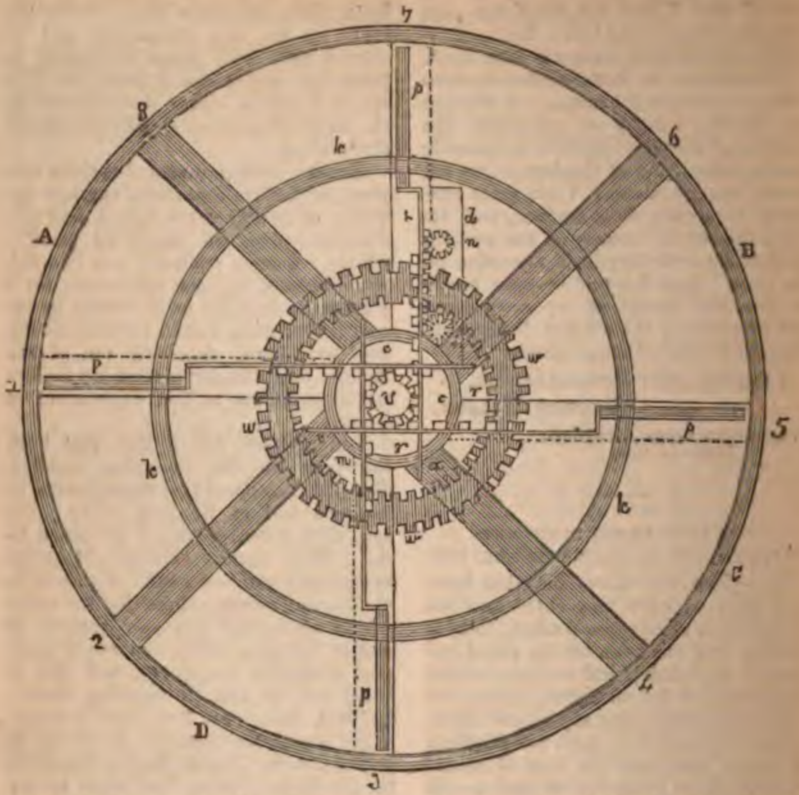
You will see, Mr. Editor, that both the plans are for moveable paddles. When I mentioned this to engineers in America and in England many years ago, they ridiculed what I proposed to do. They urged various objections against any and every kind of moveable paddle, and among others that the water would injure the pivots or centres of motion of the paddles and would soon rust away the machinery, and that it could not be kept in working order; and last, though not least, they strongly urged the same objection to moveable paddles, as Sir Joseph Banks, President of the Royal Society had done to my proposal of steam navigation nearly thirty-two years ago, by saying, "It was impossible to make the machinery strong enough for the purpose." But it seems by the advertisement of Mr. S. Hall, on the cover of your Magazine, that that gentleman has found the means to make the machinery strong enough? And why should not I have done the same had the opportunity been allowed to me? As I know nothing of Mr. S. Hall's plans, I now hasten to send you two of my own before I shall have seen anything on this subject proceeding from or belonging to that very fortunate person!

Description of Figure No. 1.

A, B, C, D, the extreme rim or outer frame of the paddle-wheel.

k, *k*, *k*, the inner rim or strengthener of the paddle-wheel.

c, *c*, *c*, is that part of the shaft or axle of the paddle-wheel which is contained between the inner frame of the wheel



next to the boat or vessel, and the corresponding outward frame of the wheel: it is a hollow cylinder of cast iron or other suitable metal, with spaces or apertures therein to admit of the racks *r*, *r*, moving freely backward and forward; it is to be cast with flanches for receiving the bolts and screws, &c. necessary for securing it firmly to the framework and radii of the wheel.

p, *p*, are the paddles or float boards.

r, *r*, the toothed racks whereby the paddles are drawn towards the centre of the paddle-wheel, and pushed back again towards the extremity thereof; each paddle may have two of these toothed racks.

The wheel in the centre marked *v*, seen endways looks like a wheel, but is more properly a fluted roller, placed inside of the cylindrical part of the shaft *c*, *c*, *c*, and extending very nearly its whole length, it moves freely upon its pivots or centres inside of *c*, *c*, *c*.

w, *w*, *w*, the internal and external toothed wheel.

d, *n*, *s*, a sliding frame easily thrown, or out of gear.

n and *s*, two small wheels fixed in the aforesaid sliding frame; the wheel *n* acts on the external teeth of *w*, *w*, *w*, and the wheel *s*, acts on the internal teeth of the wheel *w*, *w*, *w*.

r, *t*, the rack that acts upon the wheels *n* and *s*. This rack has also one set of teeth that act on the centre wheel *v*.

1, 2, 3, 4, 5, 6, 7, 8, refer to the eight paddles in this wheel.

Note.—The eight pairs of spokes of the paddle are each provided with a groove in which the paddles securely slide backward and forwards as required. In the numbers 2, 4, 6, and 8, it was not necessary to delineate the paddles and racks, for that would have created much indistinctness and confusion in the drawing, but only the spokes of the wheel. It may be proper to remark that

the wheels *n* and *s* are similar to the wheel *v*, or, a sort of fluted roller sufficiently long to act on the rack *r*, *t*, and the wheel *w*, *w*, *w*, both at the same moment.

Now, by observing the foregoing description it will be easily seen that by turning the wheel, *w*, *w*, *w*, according as the little wheel *n* is brought into gear on its external teeth; or, as the little wheel *s* is brought into gear with the inner teeth of *w*, *w*, *w*, that the paddles will all be drawn towards the centre, or pushed towards the extremity thereof: and this may be effected if desired while the paddle-wheel is revolving, by having a hand lever properly fixed, so as to bring its shorter arm to bear upon the aforesaid double toothed wheel. It will also be seen that the paddles will, from the peculiar construction of the machinery, remain at whatever distance they are placed from the centre, as one part will always be kept in equilibrium with the other. We may also remark, that by fixing a small wheel at *m*, similar to the wheel *n*, and having the rack at *m* like the rack at *r*, *t*, double toothed, we might dispense with the wheel *w*, *w*, *w*, and by turning either of these wheels with a crank lever similar to the old-fashioned watch keys, cause the paddles to move towards the centre, or to recede therefrom as desired. But in the latter mode of construction it would be necessary to stop the paddle wheel while this operation was being performed. By having an opening down the middle of each paddle, its whole length or nearly so, it would tend to prevent the lifting of the water, which causes a great waste of the power of the engine where paddles of the common construction are used; and moreover, it does appear to me that eight or twelve paddles in each wheel would answer the purpose much better than three or four times the number, rendering the machinery lighter and at the same time more effectual in its operation of propelling the vessel and not lifting the water, as must be done when many paddles are in one wheel; one paddle being thoroughly immersed, one entering and another leaving the water, if the wheels be properly constructed will better economise the power of the engine than in a wheel where there are eighteen or twenty float boards in the water at one time.*

The drawings marked figures Nos. 2 and 3, are another plan of mine invented also by me upwards of twenty years ago for a paddle wheel whose floats enter the water, pass through it, and leave it perpendicularly. Though I never saw Mr. Morgan's, yet I believe this to be identical in principle, if not in plan, to Mr. Morgan's paddle wheel, but invented by me no doubt many years before that gentleman thought of such a thing; thus we see that it is the destiny of one man, to gain honors and fortune for doing the very thing that gains for another, much less fortunate, only ill will and ridicule. I have another example of this in my own person, for the very plan I submitted to the President of the Royal Society upwards of thirty-one years ago, is very similar to the marine steam-engine for which Messrs. Seaward and Co. claim for themselves so much honor and emolument, as I can convince you, Mr. Editor, by documents in my possession. The honorable and learned President's letter to me is dated in October, 1808, and my drawings of the plan of my first marine steam-engine therein referred to, prove their own originality, and that the paper on which they are delineated is three-and-thirty years old; so that I hope Messrs. S. or any others who have benefited so largely by steam-engines will see at once that I am not a new competitor, but rather a predecessor to them in this department of mechanical science.†

Hoping that I have rendered these explanations sufficiently explicit to all your very numerous readers,

I remain, Sir,

Yours very respectfully,

THOMAS OXLEY,

Teacher of Mathematics, &c. &c.

3, Elizabeth-place, Westminster-road,
March 4, 1840.

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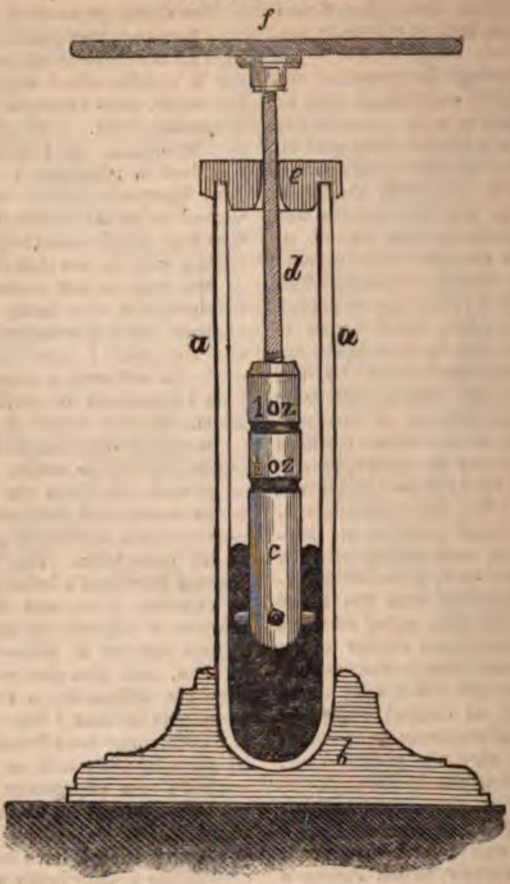
* There are seldom more than four paddles in the water at one time under ordinary circumstances. —ED. M. M.

† Mr. Oxley's feathering paddle wheel which he imagines to be exactly like Morgan's, (which was invented and patented by Mr. Galloway) is certainly upon the same principle of construction; but it is so nearly similar to the modification proposed by Mr. Mackintosh in vol. xxv, p. 33, of the *Mech. Mag.* that it would be unnecessary repetition to publish it.

We should be happy to receive copies of Mr. Oxley's communication to the Royal Society upon

SIR JOHN ROBISON'S MERCURIAL LETTER-BALANCE—PIRACY OF REGISTERED INVENTIONS, ETC.



Sir,—Some discussion having arisen in your pages, upon the subject of mercurial letter-balances, chiefly with reference to priority of invention, I beg leave to submit the following remarks elucidatory of the matter at issue.

The *principle* is as old, certainly, as the time of Archimedes, and its varied application to particular purposes seems to be all that is left us in the present day. Mr. G. H. Bursill has stated in your 865th Number, that about six years ago he constructed a mercurial *money-balance*, of great delicacy, but it is only very recently that he has applied a similar instrument to the purposes of a letter-weigher.* In December 1839, Mr. Wm. Lund, of Fleet-street, registered a mercurial letter-balance, and a few days afterwards (on the 12th,) a similar contrivance was registered by Mr. A. F. Osler.

It is in evidence, however, that in the preceding month, (that is, in November) Sir John Robison, Secretary of the Royal Society of Edinburgh, constructed a mercurial letter-balance, of which a sketch is prefixed. It consisted of a glass tube

the subject of steam navigation, and of Sir Joseph Banks's answer. The public will then be the better able to judge of Mr. Oxley's merits, and of the short sightedness of the heads of science of former days.—*Ed. M. M.*

* Vide List of Designs registered in March, at page 478.

a a, mounted in a wooden stand *b*. A cylindrical plunger of ivory *c*, floats in the mercury with which the glass tube is charged, marked with two broad red rings, the lower edges of which are so adjusted as to mark the extent of immersion when loaded with half an ounce, and one ounce respectively. A steel wire *d*, rises from the plunger, furnished at the top with a circular disc of ivory, &c., *f*, for the reception of letters to be weighed. The steel wire moves freely up and down through an ivory cap *e*, which fits the interior of the glass tube; the parallelism of the stem, &c., is maintained by four guide pins placed at the lower part of the plunger. Sir John Robison made several of these mercurial letter-weighers early in December for various friends, which were immediately very extensively copied, at first with his permission, but afterwards, not only without asking it, but in some towns, by parties, who, having purchased a model in Edinburgh claimed the invention for themselves and puffed it off as their own.

Mr. Forbes, who is the authorised maker of this article in Edinburgh, has introduced a decided improvement, consisting of a loose flat ring of ivory, which swims on the surface of the mercury, and shows the actual descent of the plunger more accurately than the mercury did, as in some lights the images on its surface became confounded with the marks on the plunger.

I have been informed that Mr. Osler, or somebody in his name, has been threatening the Scotch manufacturer with legal proceedings if he continues to make the articles in question, without a license from Mr. Osler. It must be confessed, that this is coming it pretty strong, inasmuch as Mr. Osler has not any real pretence for setting up such a claim. In point of *priority* of invention, the Scotch manufacturer has the advantage, and Mr. Osler cannot possibly suppose that having registered his design—he can assert an exclusive right to the *principle*. His monopoly only extends to the particular "form and configuration" which he has registered, and on this head there is sufficient difference, beween his letter weighers and those of the Scotch manufacturers, to protect them from his interference. In fact, Mr. Osler has had the good sense to avail himself of various improvements upon his registered plan, suggested by the inventions of others, so that his mercurial letter-weighers no longer retain the "form and configuration" secured to him by the registration process. This being the case, his attempt to levy contributions from the northern makers, under pretence of granting permission (by licence) to use that which he has himself abandoned, is not a very liberal proceeding.*

It should be clearly understood that no principle whatever, nor the application of any principle, can be secured by the registration process. Patterns and designs, *i. e.*, "form and configuration" alone are protected by the Designs Copyright Act.

Unfortunately, every thing which is attempted to be protected under this statute, is liable to be pirated by such manufacturers as, not being overburdened with principle, possess sufficient cunning to twist the invention into a somewhat different form, and thus fraudulently and cheaply possess themselves of those advantages, which it was the express object of the legislature, by this enactment, to secure to the *original inventor*. He has in every case to work out the crude idea—to bear the brunt of the experiments necessary to establish the invention in a practicable and useful form—to incur the expense of advertising his manufactures—and to get them up with such care and accuracy as to procure or preserve a reputation. All this accomplished, when lo, what "Jack" calls "a land shark" comes and takes up the invention "*à la* Hutchison;" by turning it up or down, a little to the right, or a little to the left—making the square, round—or the round, square—the crooked straight, or the straight crooked—the pirate contrives to possess himself of the *essence* of the original, retaining enough of its form to pass current for it, and yet possessing difference enough to screen its author from the punishment which is due to his dishonesty. The pirate, depending upon the reputation of the original, cares nothing about his own, his productions are roughly and

* Mr. Osler advertises his letter-weights as "patent." Is it upon this pretence he threatens the Edinburgh makers? We can assure our readers Mr. Osler has no patent, and that his publishing his balances as so protected, is an untradesman-like deception.

rapidly got up, and he drives a trade by underselling the victim of his arts.

In illustration, I may here observe that Riddle's bent lever letter-balance,* was no sooner established in popular favour, than a *respectable* tradesman near the Elephant and Castle, brought out a cheap modification of it *in the name of his shopman*—"ALVEY."

I was among the first to propose the employment of mercury for the construction of letter-weighers, but the result of various experiments went to show, that the friction and adhesiveness, as well as the *vis inertia* of this curious metal were so great, as to make it next to impossible to construct an instrument of sufficient delicacy for the intended purpose. In some of those now before the public these evils appear to be reduced to a minimum, but not got rid of; and the "directions for use" recommend where accurate indications to much nicety are required, to tap, shake, or spin the instrument, and so overcome these retarding influences.

I remain, Sir, yours respectfully
WM. BADDELEY.

London, March 25, 1840.

* Described in your No. 853.

PLAN TO PREVENT THE FALL OF A MINE BUCKET IN CASE OF THE ROPE BREAKING.

Sir,—The year before last I sent to the exhibition of the Royal Cornwall Polytechnic Society a model of a plan for raising miners which I had previously submitted to the inspection of several practical men, who had all expressed a very high opinion of its merits. It was not, however, considered worthy the notice of the judges, and passed the exhibition without any observation. I feel every disposition to rely on the correctness of the decision come to on that occasion; but yet, as in a greater multitude of councillors there may be more wisdom; and as, while I see the life of the miner most awfully shortened by his occupation; and while I have observed on examination of the burial register of a neighbouring parish, that 16¼ *per cent. of the deaths of miners during two years have been accidental,* I see no plan as yet at all likely to be carried into effect to ameliorate their condition. I feel a great desire to have the opinion of some of your very ingenious and scientifically competent correspondents on the subject.

My plan was that a bucket of any convenient dimensions should be provided with projections on each side to run in grooves firmly fixed on each side of the whole depth of the shaft. In the same manner, I believe, as the corves in some of the coal mines. I proposed to have the back of these grooves constructed like ladders, and furnished with strong and well-secured iron staves. To the upper end of each of the vertical projections of the bucket were to be fixed by moveable joints, one or more strong crooks, acted on by powerful springs which should continually press them, with great force, towards the staves in the back of the grooves. On the back of each of these crooks was to be fixed a very strong ring connected by chains or ropes to the principal chainor rope used to raise or lower the bucket. As long as the tension of the main rope continued these crooks would incline inwards over the iron roof of the safety bucket; but in case of the rope breaking, and the consequent removal of its restraint, the springs would force the crooks upon the staves, and the bucket remain suspended until another rope was affixed. I will not enter more minutely into a description of my plan, the model of which worked in the most satisfactory manner, and will only beg to ask the opinion of any of your correspondents in the coal districts as to the practicability of its introduction in the grooved shafts already constructed, and to solicit any competent opinions on its suitability, or otherwise, to the purpose for which it was suggested.

I very much fear that unless the press take up the subject, very little benefit will result to our deserving but much suffering mining population from the annual exhibitions of the Polytechnic Society; and I should rejoice to see your influential journal enlisted with that society in its benevolent efforts in behalf of our working classes.

I remain, Sir,
Very truly yours,
R. BLEE, Jun.

Redruth, Dec. 30, 1839.

LONG AND SHORT STROKES IN STEAM ENGINES.

Sir,—I am glad to see that the question of the advantages of long or short strokes in steam-engines has been raised by one of your correspondents, and I hope that it will not be suffered to rest until it has been fully investigated and settled one way or the other.

I have often considered this subject, but have been unable to determine to which to give the preference, and I can only state a few of the circumstances which appear to me to influence it. Suppose two engines with cylinders of equal capacity; one with half the length of stroke, but of twice the area of piston of the other, making an equal number of strokes per minute. In the friction of the piston the short stroke has the advantage, for the rubbing surface does not increase in proportion with the area, but with the length of stroke and circumference of the piston. The loss of steam by cooling in the cylinder (which is said in Tredgold's work to be the only circumstance of importance) is least when the stroke is twice the diameter—the loss of steam at the top and bottom of the cylinder by the necessity of leaving some space beyond the motion of the piston, is just double in the short stroke what it is in the long one. By the drawings of engines in Tredgold's work the spaces left vary from one to four inches. In the *Wilberforce* it is three inches ($1\frac{1}{2}$ inches at each end) and as the diameter is 60 inches there is a loss of almost 5 cubic feet each double stroke—the stroke is 6 feet, so the loss is $\frac{1}{4}$ of 8th part of the steam employed. The framing of an engine must be made stronger in proportion to the distances of the points of action from each other; the beams, piston rods, connecting rods, &c. must be made stiffer as their length is increased, although the stress is but half as much. The twisting strain on the crank shaft is the same in both cases, and the pressure on the paddle bearings is always in one direction, but on the bearings next the crank it varies with the motion of the connecting rod; the fulcrum and the power are continually changing their relative positions while the resistance remains in the same situation. When the power and resistance are on the same side of the fulcrum it is evident that the strain and friction upon the latter are reduced by applying the power as near the resistance as possible, but on the opposite part of the stroke the strain on the bearings is equal to the power and resistance together at whatever distances they may be applied. If I am incorrect in this statement I shall be obliged to any of your correspondents who understand it better for correcting it.

In most English marine engines the framing, beams, &c. appear to me to be unnecessarily heavy; in the *British Queen*, for instance, an immense weight of iron seems to be uselessly employed in Gothic architecture, and the beams weigh five tons each. Now in America a light frame of wood and iron is used, which when properly constructed is sufficiently strong, and the beams are generally made of wrought iron with iron straps connecting the extremities to strengthen it.

The speed of the American steam boats is obviously owing to their superior models and to their working their engines expansively and at much higher pressure of steam than is used in this country, and also to the very great velocity of the pistons (some of their engines of ten feet stroke making 30 revolutions per minute.) But I cannot see that the length of stroke has any thing to do with their speed.

After all I have said I do not feel sufficient confidence to express a decided opinion, and in the hope that these remarks may be some assistance to any who are investigating this subject,

I remain your obedient servant,

V. R.

ON THE LENGTH OF STROKE OF STEAM-ENGINES.

Sir,—In answer to your correspondent, "An American Mechanic," on the length of stroke of steam-engines, I beg to say that I have for a long time considered the length thereof should be regulated by the kind of work the engine is expected to perform. The query therefore as to what proportion the length of stroke should bear to the diameter of the cylinder, I do not think *a propós*, as the diameter of cylinder I consider has not anything whatever to do with the length of stroke; and the only consideration relative to the dia-

meter thereof is to have it large enough to give the power required, whether the stroke be short or long. Your correspondent appears to have an idea that some certain length of stroke must necessarily be best, if we could determine it. Now, I consider if he were right in this conjecture, and that experimenting upon some engine doing any certain description of work, lengthening or shortening the stroke, till such a *desideratum* were obtained,—although some advantage might be realized thus by an engine doing this particular kind of work, it would be no criterion whatever as to constructing engines for other purposes. As I have stated, I have long considered that the length of stroke should be proportioned to the kind of work required from an engine, and not to any diameter of the cylinder. If heavy slow work be required it would be preposterous to have cylinders as short as locomotives. And again, where a quick movement is requisite, as for circular saws, turning, locomotives, &c. a slow long stroke is equally out of place. From the necessary combination of heavy wheels and shafts much power is lost by friction; and the expense of their construction unnecessarily thus incurred, to obtain a quick movement from a slow going engine with a long stroke; whilst, on the contrary, to obtain a slow movement for heavy work, from an engine with short and quick strokes is ineligible on other accounts, and is almost impracticable from the strain it would have upon the shafts and wheels necessary thereto, and of which I will give some illustrations hereafter.

The subject of your correspondent's communication relates principally to steam-boats, which obviously require a very strong, but not a rapid movement, and engines therefore with great length of stroke. I am aware as well as your correspondent, of the increasing length of stroke of American marine engines in which Mr. Stevens, of Hoboken, near New York, led the way. When he had got to our 8 feet stroke, I said he would not stop till he got to one of 12 feet; he soon got to 10 feet, and I believe he has no engine now constructed with a less stroke than 12 feet. Now, if we consider that the length of the *crank* of an engine depends upon the *length of stroke* thereof, and acts similar to the winch of a grindstone or other machine turned by hand, it must be obvious that the length thereof from the handle to the axis is a matter of consideration. For a quick movement the handle should be much nearer the axis than for a slow one, such as turning a grindstone. So also should the crank and stroke of an engine be long for slow work. I am aware that this comparison with the application to human power does not quite apply. Still there is a sufficient analogy to elucidate. I cannot agree with your correspondent that Professor Renwick has mounted the old hobby he alludes to, although he has probably not expressed his meaning in such choice terms as he might have done. Power saved is power gained as to use; if therefore there is less strain upon the main shaft from the use of a 12 feet crank than from one of say 5 feet, the engine will work more sweetly, as it is called; that is, with less friction; and as the strain is much less, the weight of the main shaft need not be so heavy. Now these are just what I consider the advantages of a long stroke in marine engines; and that the power thus saved is used effectively, and that this constitutes the advantage thereof; and I, as an American, do not fear any disparagement from what your correspondent considers as the Professor's "blunder." A consideration next follows, namely, whether the cranks and strokes of these engines might not to advantage be still further lengthened. To which I say, I see nothing to augur otherwise, and no objection, until the length becomes a greater inconvenience than the advantage to be gained therefrom; and we must also consider that the size of paddle-wheels has also been continually increasing; perhaps before very long, the stroke of American marine engines will be increased to 15 feet. I must also totally differ from your correspondent where he states it as "a fact well known to travellers, that the best, and steadiest sea boats upon the American coast, are those which have the upper works of their engines considerably elevated above the deck, and *their boilers upon the guards.*" I do not recollect having ever seen any "such sea vessel," with her boilers so situated, and I should consider such a vessel quite unsafe at sea, even in a very moderate storm. My

brother Jonathan might, I dare say, be tarnation proud to descry a Yankee at sea, with the beam of her engine, as he says, working half way up to her mast-head; but for my part, I should see no fun in it. In the first place, I have a great dislike to these ponderous old fashioned means, particularly for marine engines. In the next place, they are a great eye-sore, thus working high upon deck, although those used only to them, do not perhaps think so. But how it can be inferred, that they are as safe, or safer than vessels with their engines under deck, I cannot even "guess" at, nor do I think it needs any refutation. I, as well as your correspondent, can see no reason, if, as I have endeavoured to show, and experience has proved in the United States, that long cylinders for steam vessels have an advantage over short ones, why, they should not be adopted in steam vessels here. I should regret, however, to see any part of the machinery above deck; but a portion of the deck might be elevated to give more height for the engine if requisite. I further agree with your correspondent that an engine with a long stroke, must be equally valuable to sea, as to river vessels.

Engines are made in New York, and I believe in Boston too, with as short a stroke as from 10 to 14 inches; they are extremely cheap, and removeable, and may be worked in a room of any building. They have two cylinders which work alternately two cranks on the same shaft; and thus a very quick motion is obtained. On their first introduction it was supposed they would do any kind of work, but when the velocity was diminished by wheels and shafts, for slow work, such as grinding, working the blasts of iron furnaces, rope-making, &c., they failed in effect; whilst for working a quick movement, they are much more effective than engines with long strokes, from which slow movement, a quicker one is obtained by means of wheels and shafts. Since the introduction of short strokes in the engines of locomotives, I expect English engineers will have less prejudice against them. And it must be obvious, that to assimilate the speed of the engine to the speed required for any work without the intervention of extra and unnecessary *shafts* and wheels, must save *the power required* to work those shafts and wheels, and also the expense of constructing them. Thus, in all factories requiring two very different kinds of speed, there will be a great advantage in having two engines with lengths of cylinders accordingly.

I hope I have made the position I first started with sufficiently clear, namely, that the length of stroke of an engine should not be in any proportion to the diameter of its cylinder, but should be wholly governed by a consideration of the work such engine is required to perform.

I remain, Sir, yours, &c.

J. SCHOLS.

MR. BERNEY'S PATENT CARTRIDGES.

We witnessed last week some very interesting experiments made in the shooting ground at Chalk Farm with a new cartridge invented and patented by Thomas Trench Berney, Esq., of Morton Hall, Norfolk, in the presence of a number of eminent sportsmen, gun-makers, &c. In this cartridge, for which a patent has been procured, the shot is enclosed in a spiral wire case which is tapered towards the end, and provided with a cushion at bottom formed of wool, moss, tow, or any other soft elastic substance, to prevent by its elasticity the sudden explosion of the powder from breaking the case or jamming the shot. The case expands after its discharge from the gun, and according as the coils are more or less apart is the distance to which the bulk of the shot may be carried before escaping through the coils. Three experiments were first made with a common duck gun charged with No. 6 shot in the usual manner, and fired by Mr. Berney against a 2 feet 6 inch iron target at 40 yards distance. The average number of shot which hit the target was 126. Fifteen shots were then made with the same gun charged with the patent cartridge, at distances varying from 40 to 60 yards, and the average number of shot carried home was 256, making a difference in favour of the patent cartridge of 130. It was also evident that the force with which the shot from the patent cartridge struck the iron target far exceeded that fired in the ordinary way. Among the gentlemen on the ground was that dis-

tinguished sportsman and excellent judge of projectiles, Colonel Hawker, who declared emphatically that the performances of the cartridge were quite "wonderful."

PATENT LAW ADJUDICATIONS.

Vice-Chancellor's Court, Saturday, March 21.

Elkington v. *Phipson.*

This was a motion for an injunction to restrain the defendant from using a certain invention for the purpose of gilding metals of various kinds, which the plaintiff alleged to be an infringement of several patents he had obtained for a new method of coating metals with gold, platina, and silver. The plaintiff described his invention to consist in the application of a solution of gold combined with any convenient salts, preferring those of potassium or sodium or ammonia, excepting carbonate of potash or soda, and giving the preference to chlorides of potassium and sodium with the borates and muriate of ammonia for the purpose of gilding metals. The plaintiff had perfected his invention with three different patents, and after it had been sometime in use, the defendant commenced employing a solution for the very same purposes, which he alleged to be composed of different substances. The defendant's process was said to have been discovered by Mr. Woolrich, a chymist at Birmingham, who applied for a patent subsequently to the plaintiff having obtained his. The plaintiff entered a *caveat* against the application, and on a separate hearing before the Solicitor-General (Sir R. Rolfe), a patent was refused. The grounds of the refusal were very indistinctly stated. The defendant soon after met the plaintiff in Birmingham, and declared that he was convinced his invention was no invasion of the plaintiff's patent, notwithstanding the refusal of the Solicitor-General to grant the application, and that he should continue to use it. The only novelty in the case was, that the defendant had refused to disclose in what his invention consisted, any further than negatively stating, in a detailed manner, that some of the chief ingredients and the peculiar mode of employing them by the plaintiff were no part of his process. The main allegation in support of the plaintiff's case was, that chymical salts in some form or other was an indispensable ingredient in the composition, that he had sufficiently laid claim to every kind of salts, in whatever *manner they* might be obtained, by first *stating the particular* salts he made use of, *and then that* any other would be equally *convenient*, and that it was not possible he could set forth in his specification every known substance from which they might be obtained, as there were already above 5,000. Salts in some form, it was contended, the defendant's process must contain. The defendant attacked the plaintiff's patent as uncandid and not sufficiently definite. Refusing to reveal his own secret, he insisted it was altogether different from the plaintiff's, and new, and that the open manner in which he had used it for 18 months, with notice to the plaintiffs, during which time three assizes had afforded opportunities of establishing the legal validity of the patent, was a sufficient ground for the Court not now interfering by injunction.

Mr. K. Bruce, *Mr. Jacob*, and *Mr. Wright* appeared in support of the motion; and *Mr. Wigram* and *Mr. Bacon* for the defendants.

The *Vice-Chancellor* said, before granting an injunction in such a case as the present, the Court must be satisfied there was a reasonable colour of right in the plaintiff to what he claimed by his bill. The plaintiff alleged that the defendant was infringing that thing the exclusive right to which was admitted to be secured to the plaintiff by patent. This the plaintiff expressly denied. Then it appeared that an application was made to the Solicitor-General by the defendant for a patent for his invention. What took place before him was not clearly represented on the affidavits. The express words the Solicitor-General used were not stated, though one affidavit described that he "intimated" so and so. His Honour could not help admitting that what appeared on the affidavits tended to throw suspicion on the accuracy of that part of the defendant's statement which represented that he was doing a different thing from that to which the plaintiff claimed the exclusive right. It appeared from the affidavits there had been some difference on the subject between the plaintiff and defendant, and some way of settling the matter by arbitration was proposed, but all the while the plaintiff well knew the defendant was insisting on the benefit of his discovery, and yet the plaintiff never took any step to restrain the parties engaged from doing what they asserted they had a right to do. Therefore his Honour could not but think, though the plaintiff might have gone on for some time exercising his invention, that there had been any thing like an admission by the defendant that the plaintiff either had the legal right to do what he was doing, secured by the patent, or that the defendants had not a right to do what they were doing. If there had been no infringement, there was no ground for interfering; but supposing it was proved

there had been an infringement, it then became a question whether, attending to the peculiar circumstances of the case, the Court ought now to interfere, seeing a question was raised on the validity of the specification. Now, it appeared that one essential ingredient in the patent was some kind of chemical salt, and there were more than 5,000 different salts; and if it became a question what was a convenient salt, the labour and expense of a trial at law was thrown on those who were to prove what was a convenient salt. It might happen that the patent was good: but his Honour thought it was not his province, when an application was made for an injunction, to determine whether the patent was good or not. He thought, under all the circumstances of the case, he was not at liberty to say that an injunction should be granted, but that all the Court could do was to direct the plaintiff to bring such action as he should be advised, to try the validity of his patent, reserving the consideration of what should be done with the motion until the right had been determined at law.

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 28TH FEBRUARY AND THE 27TH MARCH, 1840.

James Beaumont Neilson, of Glasgow, gentleman, for certain improved methods of coating iron under various circumstances, to prevent oxidation or corrosion, and for other purposes. Patent dated Feb. 29; six months to specify.

Rowland Macdonald Stephenson, of Upper Thames Street, civil engineer, for an improved method, or methods of adjusting, shifting, and working theatrical scenery and apparatus. Feb. 29; six months.

Richard Edwards, of Fairfield-place, Bow, dealer in emery cloth, for improvements in preparing and combining of materials used in lighting or kindling fires. Feb. 29; six months.

John Sylvester, of Great Russell-street, engineer, for improvements in the construction of doors and frames, for closing the openings of fire-places, ash pits, flues, chimnies, and certain retorts. March 3; six months.

Joseph Shore, of Birmingham, merchant, for improvements in preserving and covering certain metals and alloys of metals. March 3; six months.

James Horne, Clapham Common, Esq., for improvements in the stuffing boxes of lift pumps. March 3; six months.

Joseph Clisild Daniell, of Limpley Stoke, Wilts, for an improved method of preparing shoot or weft to be used in weaving woollen cloth, and cloths made of wool and other materials. March 3; six months.

John Rangeley, of Camberwell, gent., for improvements in the construction of railways, and in the means of applying power to propelling carriages and machinery. March 3; six months.

William Craig, of Glasgow, engineer, and William Douglas Sharp, of Stanley, Perthshire, engineer, for certain improvements in machinery for preparing, spinning, and doubling cotton, flax, wool, and other fibrous substances. March 3; six months.

Joseph Norton, of High Bridge Mill, York, manufacturer of fancy cloths, and George Collier, of the same place, mechanic, for an improvement in looms for the weaving of figured and twilled fabrics. March 4; six months.

Joseph Bower, of Hunslet, Leeds, soda ash manufacturer, for certain improvements in the manufacture of carbonate of soda. March 4; six months.

Charles Alexander Petterin, of Leicester-square, gent., for improvements in wind and stringed musical instruments. (A communication from a foreigner.) March 4; six months.

Charles Kober, of Leadenhall-street, munufacturer, for improvements in fixing color in cloth. March 7; six months.

Caroline Julia Sophia Cox, of Addison Road, Kensington, spinster, for an improved mode of fastening and uniting the edges of the divided parts of shoes, boots, bandages, packages, and other articles of dress and utility. March 7; two months.

Joseph Atkinson, of Round Mill, York, farmer, for improvements in thrashing and winnowing machines. March 7; six months.

Robert Molyneux, of Southampton Row, chronometer maker, for an improvement, or improvements in chronometers. March 7; six months.

William Maltby, jun., of Mile End, chemist, and Richard Cuerton jun., of Percy-street, brass founder, for improvements in extracting and concentrating the color, tanin, and other matter contained in vegetable and animal substances. March 7; six months.

Luke Hebert, of Birmingham, C. E., for improvements in the manufacture of cofered spades and shovels, soughing and grafting tools, and other implements of a like nature. March 7; six months.

Hayward Tyler, of Milton-street, Cripplegate, engineer, for certain improvements in machinery, or apparatus for impregnating liquids with gas, including bottles for retaining, keeping, and preserving liquids so impregnated also in the manner of filling and closing such bottles. March 7; six months.

James Knowles, of Little Bolton, Lancaster, coal merchant, for an improved arrangement of apparatus for regulating the supply of water to steam boilers. March 10; four months.

George Gwynne, of Portland Terrace, Regent's Park, gent., for improvements in the manufacture of candles, and in operating upon oils and fats. March 10; six months.

William Forrester, of Barrhead, Renfrew, manager, for certain improvements in sizing, starching, dressing, and otherwise preparing warps, for weaving fabrics, and on the machinery and apparatus therewith connected. March 11; six months.

Thomas Peet, of Bread-street, Cheapside, gent., for certain improvements in steam engines. (A communication from a foreigner). March 11; six months.

Richard Smith and Richard Hacking, both of Bury, Lancaster, machine makers, for certain improvements in machinery, or apparatus for drawing, slubbing, roving and spinning cotton, wool, flax, silk, and other fibrous substances. March 13; six months.

Etienne Robert Gaubert, of Paris, professor of mathematics, for certain improvements in machinery or apparatus for distributing types or other typographical characters into proper receptacles, and placing the same in order for setting up after being used in printing. March 13; six months.

James Hadden Young, of Little France, merchant, and Adrien Delcombe, of the same place, manufacturer, for an improved mode of setting up printing types. March 13; six months.

Robert Haricas, of Burton Crescent, surgeon, for improvements in rendering fabrics and leather waterproof. March 16; six months.

William Crofts, of Radford, Nottingham, machine maker, for improvements in machinery for the purpose of making figured or ornamented bobbin net, or twist lace, and other ornamented fabrics, looped or woven. March 16; six months.*

Jean Francois Victor Fabien, of King William-street, city, for improvements in rotary engines to be worked by steam or other fluids. March 16; six months.

Thomas Craddock, of Broaheath, Radnor, farmer, for a certain improvement or improvements in

steam-engines and steam boilers. March 16; six months.

Richard Smith and Richard Hacking, of Bury, Lancaster, machine-makers, for certain improvements in machinery for spinning cotton and other fibrous substances. March 16; six months.

Isham Baggs, of Cheltenham, gentleman, for improvements in engraving, which improvements are applicable to lithography. March 17; six months.

Moses Poole, of Lincoln's Inn, gentleman, for improvements in producing and preparing leys for soap-making, and in the manufacture of soap. (A communication from a foreigner.) March 17; six months.

Samuel Seaward, of the Canal Iron Works, Poplar, engineer, for certain improvements in the construction of steam-engines, and in the application of steam-engines to propelling ships and other vessels. March 17; six months.

Sir William Burnet, of Somerset House, Middlesex, knight, for improvements in preserving animal, woollen, and other fibrous substances from decay. March 19; six months.

John Jackson, of Manchester, nail and bolt manufacturer, for certain improvements in the manufacture of nails, nuts, bolts, and rivets. March 19; six months.

Thomas Stirling, of Limehouse, patentee of the Rapid Filterer, for improvements in the manufacture of fuel. March 20; six months.

Francis William Gerish, of East-road, City-road, patent hinge-maker, for improvements in locks and keys, and in other fastenings for doors, drawers, and other such purposes. March 20; six months.

Charles Keene, of Sussex-place, Regent's-park, gentleman, for improvements in producing surfaces on leather and fabrics. (A communication from a foreigner.) March 23; six months.

William Newton, of Chancery-lane, civil engineer, for certain improvements in the strengthening and preserving of ligneous and textile substances. (A communication from a foreigner.) March 23; six months.

Samuel Hill, of Sloane-street, Chelsea, gent., for improvements in the making of bread and biscuit. March 25; six months.

Elhanan Bicknell, of Newington Butts, merchant, for improvements in separating the solid from the liquid parts of tallow, and other fatty matters. (A communication from a foreigner.) March 25; six months.

William Palmer, of Sutton-street, Clerkenwell, candle maker, for improvements in the manufacture of candles, and in apparatus for applying light. March 25; six months.

Henry Smith, of Birmingham, lamp manufacturer for improvements in gas burners, and in lamps. March 25; six months.

George Richards Elkington, and Henry Elkington of Birmingham, for improvements in coating, covering, or plating certain metals. March 25; six months.

Joseph Crossfield, of Warrington, soap maker, for certain improvements in the manufacture of plate glass. March 25; six months.

Samuel Knight, of Woodhouse, Lancaster, bleacher, for certain improvements in machinery or apparatus for boiling, bucking, or scouring, for the purpose of preparing and assisting the process of bleaching and dying cotton, and linen, and other fabrics and fibrous substances. March 25; six months.

James Hay, of Belton, Scotland, captain in the Royal Navy, for an improved plough, which he titles the "Belton Plough." March 25; six months.

Henry Philip Rouguette, of Norfolk-street, Strand, merchant, for a new pigment. (A communication from a foreigner.) March 25; four months.

James Sabberton, of Great Pulteney-street, Golden square, tailor, for a fastening to attach straps to the bottoms of trowsers. March 26; two months.

Alexander Southwood Stocker, of Birmingham, manufacturer, for certain improvements in manufacturing tubing, or tubes, which are applicable to gas and other purposes. March 27; six months.

Richard Prosser, of Cherry-street, Birmingham, C.E., for certain improvements in machinery, or apparatus for manufacturing pipes March 27; six months.

Henry Kirk, of Upper Norton-street, Portland Place, merchant, for improvements in the application of a substance or composition, as a substitute for ice for skating and sliding purposes; part of which improvements may also be employed in the manufacture of ornamental slabs and mouldings. March 28; six months.

LIST OF IRISH PATENTS GRANTED IN FEBRUARY, 1840.

John Juckes, for improvements in furnaces or fire-places for the better consuming of fuel.

John Leslie for improvements in measuring the human figure.

George Wilson, for an improved paper cutting machine.

Robert Montgomery, for an improvement or improvements in spinning machinery, applicable to mules, jennies, slubbers, and other similar mechanism.

S. W. Fletcher, for an improvement or improvements in the manufacture of woollen and other cloths or fabrics, and in the application of such cloths or fabrics to various useful purposes.

A. Boaden, for improvements in colouring or painting walls and other surfaces, and preparing materials used for that purpose.

NOTES AND NOTICES.

Omnibus Conveniences.—In Paris the omnibuses have a broad strap running along the roof from the door to the front, for the passengers to lay hold of, and steady themselves on entering and leaving. Perhaps an inch rope neatly covered with leather or painted canvass, smooth for the hand to glide over, would be an improvement, and either of them better than a bar, as less liable to hurt a person's head suddenly rising from their seat.

Sheerness, March 31, 1840. C. F. P.

Fire Preventive Company.—(From a Correspondent).—This Company has been induced by the great increase of fires in the metropolis to renew their experiments at their premises in Blackfriars, to show how easily houses and all other buildings may be made fire-proof by the application of a coating of their patent cement to the ceiling and partitions. An experiment took place last week in the presence of a number of scientific gentlemen, when two models of a ceiling or partition were exhibited; one prepared in the usual way with lath, lime, and plaster, the other with the company's composition. The models were subjected to the ordeal of fire; and while the former was very soon entirely destroyed, the latter stood the test, and when it was submitted to the gentlemen assembled was found to be uninjured. It would appear that no alteration in the mode of building is required, when it is deemed desirable to render premises fire-proof by this valuable composition.

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 870.] SATURDAY, APRIL 11, 1840. [Price 6*d*.

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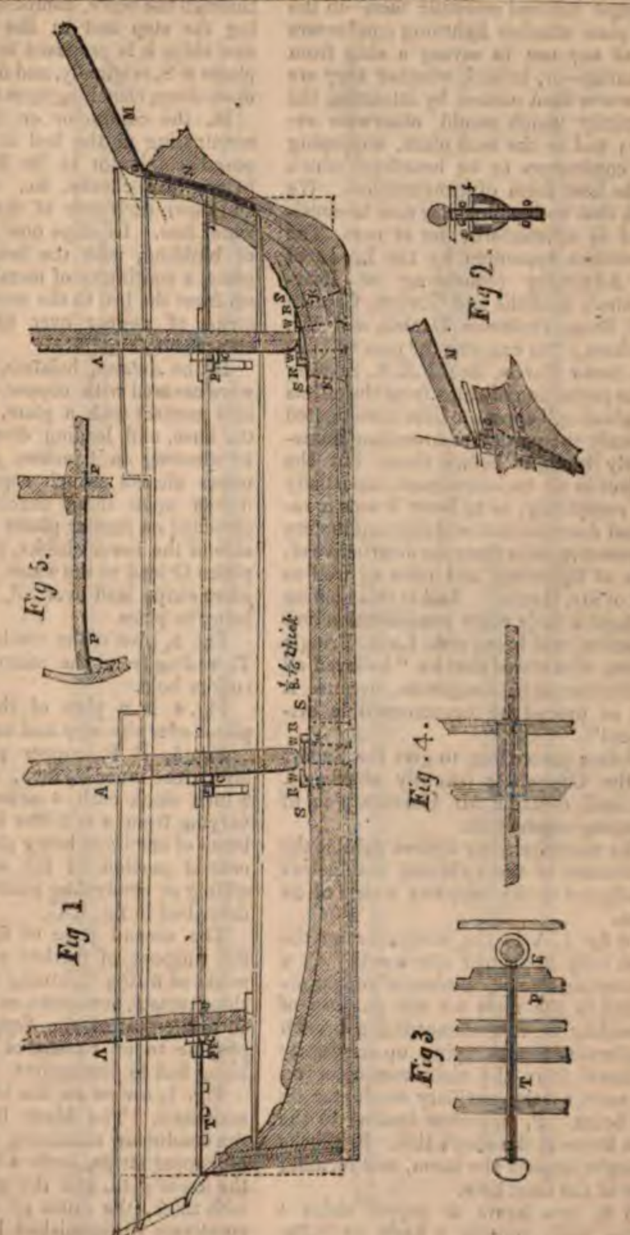
MR. W. SNOW HARRIS'S LIGHTNING CONDUCTORS.



MR. SNOW HARRIS'S LIGHTNING CONDUCTORS.

It has long been a *vexata quæstio* amongst nautical scientific men—in the first place whether lightning conductors are of any use in saving a ship from lightning—or, indeed, whether they are not worse than useless by attracting the electricity which would otherwise escape; and in the next place, supposing the conductors to be beneficial, which is the best form of construction. We think that both points may now be considered as satisfactorily set at rest. The Committee appointed by the Lords of the Admiralty (consisting of Rear-Admirals Griffiths and Gordon, Captain J. C. Ross, Professor Daniell, and Mr. Fincham,) "to examine the plan of William Snow Harris, Esq. F.R.S., relating to the protection of ships from the effects of lightning," appear to have investigated not only the particular invention immediately brought before them, but the subject in all its bearings so impartially and completely, as to leave it now a received doctrine that metallic conductors do preserve ships from the destructive effects of lightning, and none so well as that of Mr. Harris. And to this opinion we hope a little more consideration and reflection will bring even Lieut. Pringle Green, who stated that he "believed all conductors to be dangerous, because it was so proved by incontrovertible evidnce!"

Before proceeding to give the Report of the Committee (slightly abridged), we shall describe Mr. Harris's plan of lightning conductors.

The accompanying figures exhibit the application of the lightning conductors as adapted to the *Sapphire*, a ship of 28 guns.

In fig. 1, A is the conductor on the mast fully explained afterwards. C, a connecting or sliding plate of copper attached to the mast for the purpose of extending to, and connecting a branch conductor, thus keeping up continuity of metal from the main conductor on the mast to the auxiliary conductor on the beam. P, branches leading to the iron knees at the ship's side. F, chocks brought against the beam, and forming part of the mast hole.

S S, two layers of copper strips 4 inches wide, uniting 4 keels on bolts. W W, shifting wedges. R R, bands of copper 4 inches wide, in two thicknesses (as S S) encircling the step. In the common steps a band is placed through the score, completely surrounding the step and in the mortice. In new ships it is proposed to fit these new plates S S, originally, and drive the bolts upon them, clenching upon rings as usual.

M, the conductor on the bowsprit, terminating in the bed at *a*. N, proposed conductor to be fitted to ships before the cheeks, &c. are in place, and down each side of the stern to the water line. In ships now in the course of building, with the head fittings in place, a continuity of metal may be kept up from the bed to the water by leading strips of copper over all as circumstances may suggest.

In the *Actæon*, bolsters, *b b*, (fig. 2), were covered with copper, and brought into contact with a plate, G, spanning the knee, and leading down each side, terminating in flanches, *f f*. On the upper cheeks 2-inch copper bolts are driven upon these flanches, and are clenched on similar plates on the under side of the lower cheeks, as at H. The plates O lead to the water. In the *Sapphire* strips lead over all, the bowsprit being in place.

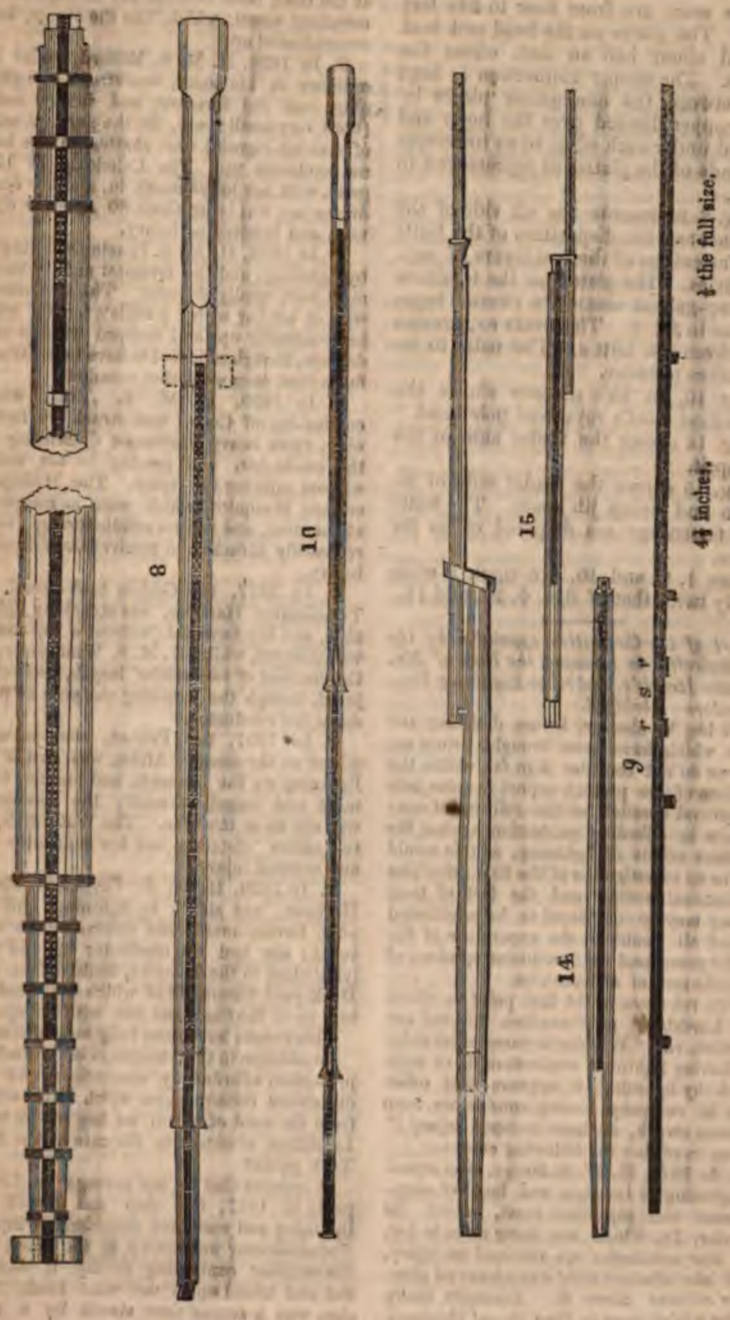
Fig. 3, plan of the conducting branch T, leading from the mizen mast to the rudder hole.

Fig. 4 is a plan of the conducting plates over the step and on the keelson.

Fig. 5, P P, copper plates in two layers, the inner $\frac{1}{16}$ inch, and the outer $\frac{1}{8}$ inch thick each, 4 inches broad, and varying from 4 to 5 feet in length; the butts of one layer being placed over the central portion of the other These sliding or connecting plates are fitted as described in fig. 1, C.

The second page of figures are for the purpose of further explaining the mode of fitting lightning conductors to ships' masts, bowsprits, and gear, adapted to the gear of the *Sapphire*, but applicable to all classes of ships, regard being had to dimensions.

Fig. 1, a view on the aft side of the mainmast. The black line represents the conductor consisting of two layers of copper strips, each 4 inches broad; the lower $\frac{1}{16}$th, and the upper $\frac{1}{8}$th of an inch thick, the butts of which are respectively distinguished by the dotted and full lines. The plates in the body


1
8
10
15
14
9
r s r
4½ inches.
¼ the full size.

of the mast are from four to five feet long. The plates on the head and heel extend about half an inch under the hoops. The copper connection is kept up between the contiguous pieces by thin copper dressed over the hoop and turned under each edge so as to receive the ends of the plates, as represented in fig. 1.

Fig. 8 represents the aft side of the topmast and the disposition of the butts and fastenings of the two layers of copper strips. The plates on the topmasts and top-gallant masts are rivetted together as in fig. 9. The rivets *r r*, are one inch from the butt *s*. The nails to be 4½ inches asunder.

Fig. 10, in like manner shows the topgallant mast's royal and pole head.

Fig. 14 shows the under side of the bowsprit.

Fig. 15 shows the under side of jib boom and flying jib boom. The butts and fastenings are disposed of as for masts.

Figs. 1, 8, and 10, are upon a scale nearly twice that of figs. 9, 14, and 15.

Report of the Committee appointed by the Admiralty to examine the Plan of Mr. Snow Harris's, and other Lightning Conductors—Abridged.

We beg to observe, before detailing the cases which have been brought before us, that we do not consider it to fall within the province of the present report to enter into the general question of the efficacy of conductors in affording protection against the injurious effects of lightning, as this would lead to an investigation of the first principles of electrical action; and the fact of their efficacy may be considered to be established beyond all doubt, by the experience of the last 80 years, and the unanimous opinions of scientific men of all countries.

With reference to the first point to which their Lordships' memorandum directed our attention, viz., "Whether in cases where ships not having lightning conductors have been struck by lightning, it appears that other ships in company having conductors have not been struck, or have escaped injury?" we beg to adduce the following cases:—

1. In 1815, H. M. S. Norge, was struck by lightning at Jamaica, and lost her main-top-mast and topgallant-mast, whilst the Warrior, 74, which was lying close to her, *with her conductor up*, received no injury, *though the electric* fluid was observed *absolutely to stream* down it. Amongst many *other ships* which were in Port Royal Harbour at the time, none received any damage but a merchant vessel, which, like the Norge, had no conductor up.

2. In 1824, H. M. S. Milford, whilst in ordinary in Hamoaze, was struck by lightning, and the foremast and foretop-mast (both very small spars, for the purpose only of making signals) were shattered; she had no conductor up. The Caledonia, of 120 guns, with her lower masts in, and her conductor up, was lying about 80 fathoms distant, and received no injury.

3. In 1824, H. M. S. Phaeton was struck by lightning, and the foremast and foretop-mast were totally shivered. The adventurer was at anchor within a cable's length, with her conductor up, and escaped without any damage, though supposed to have been struck more than once upon that occasion.

4. In 1830. H. M. S. Ætna, when coming-to, off Corfu, was struck by lightning, three heavy discharges descending by the conductor, and passing to the water without injuring the spars. The Madagascar and Mosquito, which were in company at the time, and had no conductors up, were repeatedly struck, and received considerable injury.

5. In 1837, the Cochin tank-vessel, in Trincomalee Harbour, was struck by lightning, and her foremast (without a top-mast) was shivered, whilst H. M. S. Winchester, at the distance of two cables' length, was uninjured, though the lightning was seen to pass down her conductor.

6. In 1837, the Pelican, sloop-of-war, whilst on the coast of Africa, was struck by lightning on the foremast, and lost her top-mast and topgallant-mast; the conductor was not up at the time. The Waterwich, at two cables' distance, had her conductor up, and escaped injury.

7. In 1838, H. M. S. Ceylon, in Malta Harbour, was struck by lightning, and her pole, foretop-mast, and foremast were shivered; she had no conductor up, and was lying close to the Talavera, Bellerophon, and Dock-yard Sheers, all of which had conductors up at the time, and met with no injury.

These cases have been fully authenticated.

In addition to these instances of the decided protection afforded by conductors, and the disastrous consequences which have arisen from the want of them, we beg to call their Lordships' attention to the case of the New York packet.

It appears that on her passage to Liverpool, in 1827, this ship was struck by lightning and sustained considerable injury. The conductor was not up at the time; but the weather continuing stormy, it was got out and triced up to the mast head. The ship was a second time struck by a most

severe stroke of electricity, which fused the chain, but passed into the water without committing further damage.

It would be easy to multiply instances of the local protection afforded by metallic bodies accidentally present in ships which have been struck by lightning, as well as cases in which single ships have escaped injury by means of a conductor; many such have been adduced in evidence before us; but these cases apply rather to the general question of the advantage of conductors.

Under this head of the Report, however, we may perhaps be allowed to state to their lordships the result of our inquiries with regard to the common prejudice, that conductors have the power of attracting a flash of lightning, which in their absence would not have fallen on the ship in which they are fitted.

The numerous cases of accidents to ships without conductors, and the comparatively rare occurrence of lightning having been noticed to strike on a conductor, would tend to negative such a supposition; and it may be observed, that in several instances the electricity has been seen to strike down on the surface of the water at no great distance from a ship fitted with a conductor. This phenomenon occurred in Plymouth Sound, within a moderate distance of the *Caledonia*, whilst fitted with Mr. Harris's conductors; and in the instances of the *Milford*, *Cochin*, and *Ceylon*, already mentioned, these ships, with very short spars, and no conductors, were struck by lightning when within a few hundred feet of ships with considerably higher masts and conductors up; and in the instance of the *Cochin* tank-vessel alone was the electric fluid observed to descend on the conductor of the ship which was lying near her (the *Winchester*), thus affording evidence, either of the little influence exerted by conductors in inducing or attracting an explosive discharge, or of their efficacy in harmlessly and imperceptibly conveying the electricity to the water.

As the objection of the attractive power of conductors has been brought forward by the Surveyor of the Navy as especially applicable to those of Mr. Harris's principle, it is right to state, in addition to the cases abovementioned, that with regard to Mr. Harris's, no facts have come under our knowledge which would lead us to coincide in his opinion; but on the contrary, amongst the several ships fitted on Mr. Harris's plan, which have for many years past been employed in tropical climates, and were exposed, as stated by their commanding officers, to very severe lightning, we have found great difficulty in obtaining direct evidence of their having been struck *at all*; and in two or three instances only has the fact been satisfactorily observed, and no case of injury has been recorded.

Professors Farraday and Wheatstone have been consulted on this point; and it is their unequivocal opinion that conductors possess no inherent property of attracting or inviting a discharge from a cloud at a distance.

If there be a projecting object, like a mast, within a moderate distance of the point from which the discharge takes place, the electricity will descend by it, whether fitted with a conductor or not, as affording a line of less resistance than it would meet with from the non-conducting property of the air.

"The radius within which it has been considered that a conductor will determine or conduct the electricity is double its own length, provided the discharge takes place within that space, but it has no power to cause the discharge;" on the contrary, "at all times its tendency is to draw off the electricity from the atmosphere, and thereby diminish the liability to an explosion."

In concluding our remarks on this first head of the inquiry, we beg to observe that every search has been made for cases of injury sustained by ships fitted with conductors, and though several statements to that effect have been brought under our notice, not one has been substantiated.

And no instance, so far as we are aware of, has ever occurred of a ship sustaining injury when struck by lightning if the conductor was up to the mast-head, and the continuity uninterrupted to the water.

With reference to the second head of the inquiry, namely: What conductors have been used in ships, either of the Navy or in those belonging to private merchants? we beg to state, that the conductors which have hitherto been used in the Navy, consist of a copper chain, composed of rods of about two feet in length, and ·175, or about one-sixth of an inch in diameter, with an eye at each end. These bars are linked together by rings and the conductor terminates in a rod of the same dimensions, which tapers to a point, and is made with a turn in it near the base, to receive the line to which it is attached throughout its whole length, for stopping to the topgallant backstay when triced to the mast-head.

It should be observed that these conductors are not issued to every ship, but only supplied when demanded, and one only is allowed.

A chain of similar form, composed of either copper or iron, is said to be used occasionally in merchant vessels, but we have had no opportunity of inspecting one.

In the French navy a metallic rope composed of mixed metal wire, is attached to the

mast-head immediately under the truck, leads down to the top-gallant cross-trees, and thence by the topgallant backstay to the channel, and descends into the water. A copper spindle of about three feet in length, tapering from an inch to a point, is screwed into the mast-head, nine inches of the upper end being hardened and gilded.

This description was obtained by Mr. Rice, foreman of shipwrights at Chatham Dockyard, from the officers of the French frigate *Calypso*, in 1832, when under repair. A piece of it was produced for our inspection composed of three strands of eight wires each, and measuring one-eighth and a half inch in circumference.

Mr. Harris's conductors, which have been fitted for trial in the ships named below*, are composed of two plates of copper rivetted together, so as to form an elastic and continuous line of metal; the inner plate being one sixteenth and the outer one-eighth of an inch in thickness, their breadth varying according to the class of the width of the plates which have hitherto been used, as they are considered to be unnecessarily large and the subject will be discussed in the sequel.

These plates are inserted in dovetailed grooves, in the afterpart of the masts, and extend from the truck to the keelson; a copper plate of the same dimensions is led over the caps, and the continuity is preserved at all times by a tumbler on the caps, consisting of a short copper bar with a hinge at the base, by which it leans against the conductor of the topmast, whether fidded or housed; and their lordships will perceive by reference to the drawings which accompany the Appendix, that a stop is placed on the exterior by which the tumbler is prevented from falling backwards.

Copper plates of equal dimensions to those on the lower masts are placed under the heels and steps of the masts, and are thence led along the keelson in contact with the copper fastenings.

In order to insure connexion with the copper sheathing, bolts are driven transversely through the keel, so as to meet those passing down from the keelson.

Copper plates are likewise led along the underside of the beams of the lower and orlop decks to the principal copper fastenings, and ultimately terminate in the sheathing, thereby combining all the chief masses of metal in the hull and spars of a ship with the conductors, and affording by means of its ultimate connection with the copper sheathing a vast surface in contact with the water for the dispersion of the electricity.

With reference to the third head of the inquiry, namely: What the objections are to the conductors now in use? we beg to state, that the chief objections of a practical nature which have been urged against the common chain conductors, are that not being fixtures, they are seldom ready when required, are kept packed in a box, and usually stowed away in the storerooms, and when thunder squalls arise suddenly and unexpectedly, as frequently occurs, especially in the tropics, the damage is done to the ship before they can be got out and triced up. At all times there is danger in tricing them up, as it is usually done when lightning is anticipated.

In 1834, on board the *Thunderer*, the men had not left the conductor five seconds when the lightning descended with extreme violence; and in one instance, on board a vessel in the mouth of the Mississippi, several men were struck dead at the moment of hoisting one up.

In dark nights the difficulty of tricing them up properly is greatly enhanced, and in heavy weather, when much needed, it has been found impracticable to get them up at all.

Their construction is very slight, and the rings not being welded together, a trifling strain breaks them.

In the event of a topmast or topgallant-mast being carried away the conductor is likely to be lost, and at any rate the ship is unprotected until it can be got in, and triced up to another mast. This case occurred to the *Jupiter*.

As conductors, their capacity is not sufficient for the safe transmission of heavy discharges of electricity, and in several instances the metal has been fused or disjointed. This occurred to the *Dublin* and *Ætna*.

In short, we cannot but regard them as a temporary and inadequate expedient.

By not being permanently fixed, the security of the ship is left to the opinion of the commanding officer as to their utility at all, or necessity at the moment.

They are not calculated to be applied in all weathers, are subject to all the casualties to which the ship's rigging is exposed, and liable to lead to serious accidents by the end being brought in board, the continuity interrupted, or the end lifted out of the water.

4. What are advantages or disadvantages of Mr. Snow Harris's conductors, as compared with others?

The advantages to be derived from the adoption of Mr. Harris's plan are, the removal at once of all the objections and liabilities to which the common chain conductor is exposed.

* *Actæon, Asia, Beagle, Belvidera, Blanche, Caledonia, Dryad, Druid, Forte, Revenge, Sapphire, St. Vincent, Spartiate.*

A continuous line of metal from the truck to the water is permanently fixed, and if it be found necessary to strike any of the masts, or one or more be carried away, a safe conductor will still remain. By its connection with the detached masses of metal used in the fastenings of the hull, and its final junction with the copper sheathing, the important advantages of great electrical capacity are obtained, and of ready means, under all circumstances, for the rapid diffusion of the electricity over a vast surface of metal in contact with the water.

Professor Farraday stated to the committee, that it was his opinion that "Mr. Harris's conductors met every case that he could possibly conceive to occur, and offered no one disadvantage or objection whatever;" and Professor Wheatstone stated, that "he could see no objection whatever to Mr. Harris's conductors in a scientific point of view."

A committee of the Royal Society, appointed in 1823, to consider the merits of these conductors, as well as Dr. Wollaston and Sir Humphry Davy, have stated their approval of the principle of Mr. Harris's plan.

With reference to the disadvantages of Mr. Harris's conductors, we beg to state that all the objections which have been brought against them have, to our minds, been sufficiently removed by the evidence adduced before us; it will be proper, however, to state these objections to their lordships, with the facts and opinions which have influenced our conclusions.

The objections may be divided under the following heads:—

1. Those of a scientific nature, involving principles of electrical action.

2. Those of a practical description, as tending to injure and weaken the spars.

3. The indirect objection on account of expense.

1st. Theoretical objections.

First. That Mr. Harris's conductors attract the lightning.

This applies equally to all conductors, and has been already refuted.

Secondly. That danger arises from the "lateral explosion."

Mr. Martyn Roberts has objected to the conductors being led through the body of the ship, on account of the dangers of lateral explosion, which he considers might set fire to the ship, or ignite the magazine. His hypothesis is, "that when a discharge of electricity passes along a conductor, visible sparks would be thrown off from the sides of the conductor to any metallic or other conducting body within a *moderate* distance, *and be capable of igniting* inflammable substances." "And that such lateral discharges would be in proportion to the capacity and propinquity of the secondary conductors, with reference to the volume of electricity passing down the primary conductor."

Professor Faraday stated, that "he was not aware of any phenomenon called lateral discharge, which was not a diversion or division of the primary current, and that all liabilities to a diversion of the main charge would decrease in proportion to the capability and goodness of the primary conductor; that in proportion as the number of the metal bolts are connected with the conductor would the probability of a lateral diversion diminish."

"It was his opinion that a lateral discharge could not be obtained from Mr. Harris's conductor, provided the continuity were not interrupted; and from the increased dimensions of the plates at the lower extremity, and the complete mode of connection with the fastenings of the hull, the electricity would be so rapidly diffused, that he doubted whether, with any intentional contrivance, the magazine could be ignited from the sides of the conductor. He could not but appeal to the evidence of experience to prove the efficacy and safety of Mr. Harris's plan; ships fitted with his conductors had been exposed to severe lightning, and the electricity had been known to descend by them with perfect security to everything on board; nor was there, so far as he could learn, any instance on record of lateral explosion."

Professor Wheatstone stated, with regard to lateral explosion, that "all the case with which he was acquainted were those o a partial diversion of the main current wher the conductor was not of sufficient capacity of conduction, in which case a portion of the electricity distributes itself to any tolerably good conductor within a moderate distance.

"This, however, had only been known to occur from a very small wire, and from a conductor of the dimensions proposed by Mr. Harris would be impossible, with such atmospheric discharges as we are acquainted with.

"The liability to such lateral diversion would be diminished in proportion to the means of diffusion; and considering the mode proposed by Mr. Harris for connecting the principal fastenings, &c., of the hull with the conductors, no danger need be anticipated from leading the electricity through the body of the ship, or within a few feet of the magazine, so long as the continuity was maintained."

Notwithstanding this evidence, Mr. Martyn Roberts subsequently communicated to

the committee that he had made further experiments on a larger scale, which favoured his idea of the danger to be anticipated from lateral explosion."

Professor Wheatstone was in consequence requested to attend to receive from Mr. Roberts himself an explanation of the experiments which he had instituted; and we beg to subjoin the further opinion of Professor Wheatstone on the subject, which he communicated in writing.

"When the known conditions of a good lightning conductor are fulfilled, it is physically impossible that it should occasion the least accident to the building or ship to which it is attached. When injury does occur to a ship provided with one, it is because this conductor is not sufficient to carry off the whole of the discharge; the ship is then only partially protected—damage is done; but this damage must be in all cases immeasurably below what would have been produced by the whole discharge, had it not found any conductor to transmit it to the water. The danger to be apprehended from the division of the discharge may be reduced to almost nothing by increasing the dimensions and conducting power of the bars or plates which transmit the electricity, and by keeping good conductors, not connected with it, out of its immediate vicinity.

"It has been proved beyond doubt that electricity follows the best conducting path which is open to it; and that when it finds a metallic road sufficient to conduct it completely, it never flies to surrounding bodies greatly inferior in conducting power.

"The experiments of M. de Romas, made in France, with the electrical kite, immediately after Franklin's first attempt, might satisfy the most timid in this respect. 'Imagine,' writes he to the Abbe Nollet, 'that you see sheets of fire, nine or ten feet long and an inch broad, which made as much or more noise than reports of a pistol. In less than an hour I had certainly 30 sheets of these dimensions, without counting a thousand others of seven feet and under. But what gives me the greatest satisfaction in this new spectacle is, that the largest sheets were spontaneous, and notwithstanding the abundance of fire which formed them, they constantly fell on the nearest conducting body. This constancy gave me so much security that I did not fear to excite this fire with my discharger, even when the storm was violent; and when the glass branches of this instrument were only two feet long, I conducted wherever I pleased, without feeling the smallest shock in my hand, sheets of fire *six or seven feet* long, with the same facility *as those of only* six or seven inches.

"The wire of the kite was insulated, and the sparks drawn by a metallic conductor held in the hand by means of an insulating handle, and communicating with the ground by a chain. The human body is known not to be one of the worst conductors; yet because it was two feet further than a far more perfect one, it received none of the discharge, even though the conducting path was an interrupted one.

"The phenomenon to which the name of lateral explosion has been generally given was first observed by Henly, more than half a century ago, and has been subsequently experimented upon by Priestly, Cavallo, and more recently by Biot.

"I conceive it has no application to lightning conductors, but as it has been brought forward as an objection to Mr. Harris's plan by Mr. Roberts, it may be necessary to say a few words respecting its real nature.

"It takes place during the discharge of an electric battery, that is at the moment of the union of the positive and negative electricities accumulated on the opposite coatings of the jars; no part of these accumulated electricities has anything to do with the effect, which arises solely from the induction of that small portion of electricity which remains free on one of the surfaces of the battery or the conducting bodies attached thereto.

"This is the explanation of the phenomenon given by the best authorities, and, as Biot observes, theory and experiment unite in demonstrating to us that it is incomparably less than the direct discharge.

"Even, therefore, were lightning conductors liable to this lateral discharge, it would be easy to prevent any material damage arising from this cause; but after attentively considering the subject, and Mr. Roberts's objections, I am still of opinion that, in the case of lightning conductors, the lateral discharges that sometimes occur and produce mischief, arise solely from the insufficiency of the conductor to carry off the whole of the electric fluid which enters, as I have above stated, and the remedy to which is obvious."

The evidence of the officers who had served in H. M. ships fitted on Mr. Harris's plan, and had witnessed the effects of lightning descending by the conductors, as well as the absence of any case, so far as we can learn, of lateral explosion, even from the common chain conductor of such inferior capacity, so fully bear out the opinions of Professors Faraday and Wheatstone, that we do not hesitate to state our entire conviction of the futility of the objection on account of "lateral discharge."

Thirdly. That Mr. Harris's conductors do not afford a continuous line of solid me-

tal. This objection will embrace the ninth question in their lordship's instructions, namely, "Whether the continuity can be preserved in all probable circumstances, and whether the danger is not increased in case of interruption of the conductor, or of its being of inadequate dimensions?"

On this point again we beg to quote the opinions of Professors Faraday and Wheatstone.

Professor Faraday stated, that "the conducting power of the plates would be but little diminished by the continuous solidity of the metal being interrupted, so long as the portions of the conductor remained in contact; that even supposing the tumblers on the caps were, through accident, to be open to the extent of half an inch or an inch, no injury would be caused to the surrounding woodwork by the electricity leaping from one point to the other; that rope, or any substance of small conducting capacity, if placed between the two points, would perhaps be destroyed, but the probability appeared so small of any accident occurring whereby the continuity could be interrupted, that he should not hesitate to say there would be no objection to Mr. Harris's plan on that score."

Professor Wheatstone stated, "he was of opinion that if the copper plates of which the conductors were composed were in mechanical contact, there would be no danger of an explosive discharge along the line of junction; and that their capability for carrying off the electricity would be so little diminished by a slight interruption of the continuous solidity of the metal, that there could be no objection to them on the ground of being formed of separate pieces of copper.

"That the continuity of the conductors appeared to be sufficiently provided for by the tumblers on the caps, and that no danger need be anticipated supposing they were opened by accident to the extent of an inch or two, as the electricity would pass from one point to the other without damaging the contiguous woodwork."

Their lordships will perceive by reference to the description and drawings of Mr. Harris's plan that every means have been adopted to ensure the preservation of the continuity under all possible circumstances, and in no case is an interruption of any consequence likely to occur.

Fourthly. The danger of accidents to men in contact with the conductors at the moment of the electricity descending.

No instance of any accident of the sort has been known to occur.

On board H. M. S. *Beagle* the lightning was seen to strike the conductor, and though it passed within *eight inches* of the purser's head, who was asleep in his cabin at the time, he experienced no ill effects, beyond being woke by the general concussion.

Professor Faraday stated, that he believed a man would receive no injury if he were leaning against Mr. Harris's conductor when the electricity descended, and that any opinion to the contrary must be only assumption.

2. Objections of a practical description, as injuring and weakening the spars.

The surveyor of the navy and Mr. Edye stated that they were of opinion that Mr. Harris's conductors injure the spars.

First. That the nails by which they are fixed split the spars; and when the masts are strained by carrying sail, the wet might get into the splits on the weather side, and cause injury.

Secondly. That the conductors weaken the spars.

In support of the opinion that the nails split the spars, the surveyor of the navy considered he was borne out by the report of survey on the Caledonia's spars, from which Mr. Harris's conductors had been stripped.

The officers of Plymouth Dockyard state, in their report of the 15th June 1839, that "if the conductors had been allowed to remain in the spars, there would not have been any objection to their re-issue to the ship or ships to which they belonged." "That if the conductors had not been removed from the topgallant-masts and flying jib-boom, 'the rents occasioned by the nails would not have been apparent,' and the necessity for reducing the spars on account of the grooves made for the reception of the conductors would not have existed." "In several instances the injury done to the smaller spars may be attributable to the great number of nails used for fastening the conductors, and which rendered the small spars of the Caledonia unserviceable."

We beg to observe, however, in this instance, that nails are stated to have been used of two inches and a half in length to fix the copper plates, of only three-sixteenths of an inch, on a spar of six inches and a half in diameter.

The foreman of the Mast Department at Plymouth states, that "none of the spars of the Spartiate and Forte when returned into store were rendered unserviceable from the conductors, and in every instance the plates were as securely fixed as when first fitted in; that no injury from nail-holes would ever render a re-conversion of a spar necessary; and that they would never be rendered inapplicable for other or inferior purposes if the conductors were kept in."

The officers of Portsmouth Dockyard state that "they are not aware that any injury to the masts or spars was attributable to the

application of Mr. Harris's conductors." Captain Fitzroy stated, that "in H. M. S, *Beagle*, when under his command, he had never found the spars split by the nails, and did not consider that they were likely to be weakened or injured by them, as the nails were flattened at the point, and passed between instead of cutting the fibres of the wood; but allowing such to be the case, no wet could ever penetrate if the masts were kept properly greased."

Secondly. That the conductors weaken the spars, (which embraces the sixth question of their lordships' instructions, namely, "Whether the conductors of Mr. Snow Harris can be so fitted as not to weaken the spars in which they are placed?")

Captain Fitzroy stated, that "the copper plates appeared to strengthen rather than weaken the spars. In so small a vessel as a 10-gun brig, the *Beagle*, the spars were found to be improved rather than injured, and though exposed for five years to continued service, the same spars remained at the present moment in the *Beagle*, with the exception of the topgallant-masts."

Commodore Pell stated, in proof that Mr. Harris's conductors were not injurious to the spars, that after four years' service the Forte was paid off with the same masts top-masts, topgallant-masts and royal-masts.

Captain the Hon. F. Grey, Commander Turner, Captain the Hon. W. Wellesley and Commander Norcott, who had served in ships fitted with Mr. Harris's plan, were also equally of opinion that the introduction of the copper plates tended rather to strengthen the spars. Experiments were made to ascertain the point, in 1831, in Portsmouth Dockyard, under the superintendence of Mr. Harris and Mr. Rice, in the presence of several distinguished officers, &c., by which it will be seen that a spar (a jib-boom) was undoubtedly strengthened by the application of the plates, and in certain positions increased in stability upwards of a sixth; thus confirming the opinions of the officers above mentioned, who had tested the fact by experience in actual service.

Thirdly. Objections on the score of expense.

With reference to the fifth point of their lordships' instructions, namely, "What the comparative expense is of different descriptions of lightning conductors?"

The accompanying Table shows the cost of Mr. Harris's, and the common chain conductor for each class of H. M. ships*.

Class of Ships.	Expence of fitting each Ship with Harris's Conductors.			Expence of common Conductors.		
No. of Guns.	£.	s.	d.	£	s.	d.
120	365	17	8	3	2	$8\frac{1}{2}$
84	350	15	7	3	1	3
74	317	18	6	2	16	$10\frac{1}{4}$
50	286	15	10	2	13	$11\frac{3}{4}$
46	236	1	7	2	8	$1\frac{1}{4}$
28	161	18	11	1	19	8
18	119	7	2	1	19	8
10	102	12	7	1	15	0

From this account it is obvious that the adoption of Mr. Harris's plan would be accompanied with a very considerable increase of expense, but we propose to show in the sequel by what means certain reduction in their cost may be effected.

We now beg to state, with reference to the tenth head of the inquiry, namely, "Whether any other mode of fixing lightning conductors does not possess the same, or greater advantages than Mr. Harris's?" that Mr. Mr. Martyn Roberts submitted to us a proposition for avoiding the dangers he considered likely to arise on the adoption of Mr. Harris's plan from the alleged lateral explosion, by means of a rope composed of annealed copper wire, to be led from the truck down the afterpart of the masts to the lower mast-head, and thence as a backstay to the copper sheathing, to which it is to be soldered or brazed. This plan differed only from the conductor used in the French navy in its mode of application.

Mr. Edye also submitted a plan for obviating the supposed objections to Mr. Harris's conductors from their passing through the hull of the vessel, consisting of Mr. Harris's copper plates as far as the head of the top-gallant-mast (or, if necessary, to the top-mast head), and a wire-rope back-stay on each side down to the copper sheathing.

Before entering into the merits of these two plans of very similar construction, we cannot but remark on the circumstance that the chief objections urged by Mr. Edye and the surveyor of the navy against Mr. Harris's conductors equally apply to Mr. Edye's proposition, namely, the injury to the small spars from the nails by which the copper plates are fixed, and the tendency of the conductors to attract lightning.

Mr. Edye, in his evidence, states, "he considers Mr. Harris's plan would decidedly weaken the spars, and the nails unquestionably injure by causing splits and admitting the wet, as was found in the case of the Caledonia;" while his own proposition is to apply Mr. Harris's plates to the royal masts

* In this Table the expence of the common conductors is omitted, but we have added this information from another table which we find in the Appendix.—Ed. M. M.

and topgallant-masts if thought necessary, these masts being the most liable to the injury he so unquestionably states must, in his opinion, ensue.

Professors Farraday and Wheatstone were shown the drawings and descriptions of these conductors.

The former observed, with regard to Mr. Edye's, that "there was no doubt that if they could be kept in their places under all circumstances, and the rope was of sufficient capacity to carry off the electricity, they would be efficacious; but, in his opinion, their liability to derangement was far greater, their capacity less; nor were they in any one point equal to Mr. Harris's; and he should greatly prefer the latter."

Professor Wheatstone stated, that "Mr. Edye's plan of a conductor appeared to him to be liable to all the casualties to which the common chain conductor was exposed. If it could always be kept permanent, and the wire ropes were of sufficient capacity, there would be no doubt they could lead off the electricity; but their liability to accidents was an insuperable objection.

"Mr. Roberts's plan appeared very similar to the metallic rope conductors used in the French navy, and was objectionable on the same grounds as Mr. Edye's."

We entirely concur in the opinions of these gentlemen, and beg to observe that both Mr. Roberts's and Mr. Edye's plans appear to us to be equally subject to all the liabilities to which the rigging of a ship is exposed in common with the chain conductor; in the event of a topmast being carried away, the ship is left unprotected, and thus, in the hour of danger, they are liable to become useless.

The weight of the wire ropes in Mr. Edye's plan would be a great objection, especially when it is considered that the whole of this weight rests on the head of the top-gallant mast alone.

A wire rope of three-fourths of an inch in diameter, from the top-gallant mast-head (on each side) of a first-rate and an 18-gun brig, as compared with the weight of their hempen backstays, would be as follows, viz.

	Hemp.	Wire.
First-rate: Topgallant backstay..	246lbs.	357lbs.
18-gun brig......................	92	268

And as it is necessary to provide conductors for each mast-head, and their capacity must be the same, whether in a first-rate or sloop-of-war, the comparative excess of weight would be still greater in the fore and mizen masts.

In carrying sail, especially in dry weather when the rigging is slack, the metal not *being affected* in the same degree as the hempen ropes, the strain would probably be so great on the conductor, as to carry away the topgallant-mast, or the wire backstay.

It has been proposed to place a globe of glass on the mast-head in lieu of a conductor, on the hypothesis that, from the non-conducting property of glass, it would serve as a repellant to lightning; but Professor Faraday considered "it would not be a preventive, but would rather tend to increase the liability to an explosive and to a more violent rather than to a silent discharge, and would therefore increase the danger."

Professor Wheatstone was of opinion that "such a proposition was an absurd notion, and would be dangerous in the extreme, inducing, in many instances, an explosive discharge, where a conductor might have silently drawn off the electricity."

After maturely considering the several points now discussed, and the evidence, both practical and theoretical, which has been submitted to us, we are unanimously of opinion, that of all the plans of conductors which we have had under our consideration, that proposed by Mr. Harris affords the best means of preventing the injurious effects of lightning.

We now propose to show by what means the expense of fitting Mr. Harris's conductors may be reduced.

In considering this question, it will be necessary to divide it into three separate heads—namely,

First—Dimensions of the plates of the conductors.

Secondly—Abbreviation of the conductors.

And, Thirdly—The number required in each ship.

First, in order to ascertain the feasibility and safety of reducing the size of the copper plates originally proposed by Mr. Harris, it is necessary to enter into the question of the requisite dimensions of metallic rods to insure protection against lightning.

The capability or power of a metal rod for the safe transmission of electricity is in direct proportion to the area of section or its metallic contents.

A copper rod of half an inch diameter has never been known to be fused or heated red hot by an atmospheric discharge of electricity, and thus a standard of sufficiency is afforded with which all conductors may be compared.

On consideration of this fact, and the rare occurrence of the common chain of one-sixth of an inch being fused, we were led to to conclude that Mr. Harris's plates were larger, especially in the lower masts, than experience seemed to require for the safe conduction of electrical discharges, and a[s] their dimensions varied in the differe[nt]

classes of ships, and it was apparent that whatever was requisite for one was necessary for all, without reference to the size of the ship, we desired Mr. Rice to prepare a table of the comparative dimensions of Mr. Harris's conductors on the scale originally fixed by him and that proposed by us,* and Mr. Harris having expressed his entire acquiescence in the reductions, we beg to recommend the following scale of dimensions for the copper plates for the masts and spars of ships of all classes in the event of these conductors being used in future in H. M. navy: viz.—

	Inches in width.
Lower masts and bowsprits .	4
Topmasts and jib-booms . .	3
Topgallant-masts, and flying jib-booms	$2\frac{1}{2}$
To taper from hounds to truck from	2 to $1\frac{1}{2}$

The plates remaining of the same thickness in all, viz. $\frac{3}{16}$ths of an inch.

These reductions will effect a commensurate diminution in the expense, and the following account shows the cost of fitting each class of H. M. ships on the scale proposed; viz.

	Total expense of the conductors.	Value of copper as "old copper," when no longer serviceable as conductors.	Actual cost to the Crown.
	£.	£.	£.
First-rates	258	133	125
Second-rates ..	246	127	119
Third-rates ...	230	119	111
Fourth-rates ..	214	110	104
Fifth-rates....	192	99	93
Sixth-rates....	151	85	66
Sloops	98	47	51
Brigs	87	43	44

In order to remove any doubt as to the security with which these reductions may be effected, we beg to quote the following opinions.

Professor Faraday stated, that "he had no doubt the reductions of the copper plates proposed by the Committee could be effected with entire security."

Professor Wheatstone stated, that "in the Report of the Committee of the Academy of Sciences of Paris, appointed to investigate the utility of lightning conductors, it is mentioned that there is no instance on record of an iron rod of half an inch in diameter being fused or made red-hot by a flash of lightning; and considering that the capacity of copper for the conduction of electricity was from six to eight times greater than that of iron, and that the area of the section of Mr. Harris's conductors at the mast-head was ·4688 of a square inch, and in the lower masts ·7500, whilst that of an half-inch rod was ·1970, he felt convinced that they were perfectly safe."

Secondly. Abbreviation of the conductors.

It appeared to us to be a question of great importance to consider, whether the time and expense of docking ships for the purpose of drawing the copper bolts to effect the metallic continuity with the keelson bolts and the copper sheathing might not be dispensed with in cases of emergency, when ships were required to be fitted out with expedition, and at the same time that they might possess the advantages of these permanent conductors. We therefore submitted to Professors Faraday and Wheatstone, whether sufficient security would be afforded against lightning if the conductors were led down no further than the orlop-deck in line-of-battle ships and frigates, and to the lower deck in sloops and brigs, and the metallic connexion with the copper sheathing maintained alone by the transverse copper bands leading under the beams.

We beg to subjoin their opinions.

Professor Farraday stated, that "he is of opinion there would be no objection to cutting off the lower portion of the conductors, say from the lowest deck, provided that four, or even only three of the transverse copper bands leading under the beams to the copper sheathing remained, as these would afford ample means for the dispersion of the electricity.

"There would be no danger whatever from the electric discharge being thus deflected at right angles from the perpendicular line, as it would always take the line of least resistance, and is totally independent of momentum."

Professor Wheatstone stated, that "if, for the sake of economy, the conductors were carried no further than the lowest deck instead of to the keelson, he was of opinion that the transverse copper plates under the beams, if connected with the copper sheathing by conductors of sufficient capacity, would afford ample means for carrying off the electricity, and that there could be no objection to such an alteration, provided always the continuity could be equally well maintained."

The reduction in the expense of fitting tha conductors on this plan, as compared with the former account, is shown in the following estimate, viz,:—

* This table we shall give next week.—Ed. M. M.

	To the Lower Deck.—Total cost.	To the Keelson. Total cost.
	£.	£.
First-rates	229	258
Second-rates	218	246
Third-rates...........	206	230
Fourth-rates	191	214
Fifth-rates...........	171	192
Sixth-rates...........	136	151
Sloops	88	98
Brigs	79	87

By this plan of abbreviating the conductors, a reduction of about one-seventh of the expense of fitting ships would be effected; and as there appears to be no objection on scientific grounds, it may be resorted to as a safe expedient in cases of emergency. But we still would beg to recommend that the copper plates be carried down to the keelson, in all ships which may be built or docked in future.

Thirdly. The number of conductors required in each ship.

The question of the necessity of having conductors fitted to each mast and the bowsprit depends upon the confidence to be placed in the supposition that a conductor protects within a radius of double its own length, a supposition which may be considered to stand in need of confirmation by further experience.

In stormy weather, when accidents are most likely to occur, a ship may carry away a mast, and if not fitted with a conductor to each, might possibly be exposed at a moment when protection was most needed.

Professors Faraday and Wheatstone were of opinion, "that extreme cases should be provided for," and we would therefore recommend that the three masts as well as the bowsprit should be always fitted with the conductors.

While concluding our remarks on the mode of applying Mr. Harris's conductors, we beg to state to their lordships, that though it is our decided conviction that no danger is to feared from the assumed lateral explosion, yet if it be deemed advisable, for the sake of obviating any doubts which may still exist in the minds of some, we see no objection whatever to the copper plates on the foremast being placed on the fore part of the mast, whereby the mast itself will intervene between the conductors and the magazine.

Having now completed our remarks on the several points to which their lordships' instructions directed our attention, we trust we have shown, from the evidence of facts derived from the experience of many years as well as by the opinions not only of scientific but professional men, the efficacy of Mr. Harris's lightning conductors; and considering the number of lives which have been lost by lightning; the immense amount of property which has been destroyed, as shown by Mr. Harris, and is still exposed without adequate protection; the inconvenience which has arisen, and is still liable to arise from the loss of the services of ships at moments of great critical importance; the difficulty of procuring new spars in times of war on foreign stations, (not to mention the great expense of wages and victuals for the crews of ships while rendered useless till repaired; we again beg to state our unanimous opinion of the great advantages possessed by Mr. Harris's conductors above every other plan, affording permanent security at all times, and under all circumstances, against the injurious effects of lightning, effecting this protection without any nautical inconvenience or scientific objection whatever, and we therefore most earnestly recommend their general adoption in the royal navy.

We have, &c.

(signed)

A. M. Griffiths, Rear-Admiral.
Jas. A. Gordon, Rear-Admiral.
Jas. Clarke Ross, Captain.
J. F. Daniell, Professor of Chemistry
Jno. Fincham, Master Shipwright

ON INHERENT ACTIVITY, AS A PROPERTY OF THE PARTICLES OF MATTER, UNRESTRAINED BY COHESION, ATMOSPHERIC PRESSURE, OR OTHER FORCES: DEMONSTRATION THAT THIS PROPERTY IS ADEQUATE TO THE EXPLANATION OF THE DIFFUSIVE POWER OF GASES. BY HORATIO PRATER, ESQ.

The *vis inertiæ* of matter has long been recognised by philosophers; but that this same matter, under different circumstances is likewise always possessed of a power of inherent activity, is a doctrine, that notwithstanding the observations of Bywater and Brown, cannot be said to be received at present as an established point in philosophy. The object of the following observations, therefore, will be to endeavour to establish this point as a general principle, and to show that it applies not only to solids (as the experiments of Bywater and Brown sufficiently evince,) but also to fluids and gases. The circumstances under which the vis inertiæ exists, are

obviously when matter is in great masses; in which condition it may be said to be almost entirely subdued by the attractions of cohesion and aggregation. But in such circumstances alone, or chiefly, it is, that matter has no tendency to motion. This power becomes more and more obvious the greater the state of division to which it is reduced, at least when after such division it is suspended or dissolved in water or any fluid. Such is the condition for the manifestation of this power in solids: and accordingly, it seems to be pretty evident from the experiments of Bywater and Brown, that the particles of almost any powders when mixed with water in which they are insoluble, are in a state of constant motion, I have observed such motions when a little finely powdered chalk is diffused through a small quantity of water; and it seems sufficiently clear as Mr. Brown remarks, that such motions cannot be attributed to currents of air. But although such motions cannot be attributed to currents of air, another objection, viz.: that they may imply rather motion in the fluid than in the solid, (the solid moving merely in consequence of the motion of the fluids) deserves notice, for that fluids have such a tendency will be shown immediately, The fact, however, that chemical affinity exists as a power of matter, is strongly in favour of the particles of matter suspended in a fluid having a like tendency to move as the fluid itself; for the appetency to combine, certainly implies a power of motion when the two substances are mixed together; and though this does not decidedly show a tendency to motion when both are separate, still it seems to render such a tendency highly probable.* That fluids have a tendency to motion is perhaps shown by the fact just mentioned, that solids suspended in them have. But it is to evaporation we must look for the strongest argument on this point. Water at the ordinary temperature of the air is well known slowly to evaporate. In this case we have an instance of a fluid moving, contrary to gravity, *without the presence of another fluid.* In such case, therefore, its power and tendency to move, must be *inherent in itself;* for that the air has no effect in the case is obvious, since when such fluid is *in vacuo, or left still more completely alone*, its disposition to move (*i. e.* in common language, to evaporate) is so much increased, that it is said to boil. It can scarcely be urged that water moves *in vacuo* merely because the *mechanical obstacle* of the pressure of the air has been taken away, for it not only moves,

* However, that the particles of some solids, even without the presence of other solids or fluids, have a tendency to move, is shown by Professor Faraday's Essay on the Limits of Evaporation (*Phil. Trans.* 1830). This chemist found that nitrat of ammonia, mercury, corrosive sublimate, and oxalic acid in substance, volatilized *slowly* at the ordinary temperature of the air. To be sure the other solids tried did not evaporate: but this does not show they have no tendency to motion when suspended in a fluid, for it seems to require a much *stronger power of motion* to rise up contrary to gravity (as mercury, &c. do), than merely to move about when suspended in a fluid. These facts observed by Mr. Faraday, therefore, merely tend to show that some solids have a stronger power of motion than others; a conclusion to be expected from analogy; since *we find much the same* phenomenon in regard to *affinity. Every particle* of matter probably has an affinity of some sort; though certainly in extent and energy, the affinity of different matter differs much, and where affinity exists *for the same substance*, the degree of affinity is very variable in different forms of matter. It seems probable, since we find that when placed in *a void, water has its tendency to move* (*i. e.* evaporate) *increased*, as we shall observe presently, that it would be the same with solids; and that those solids which Professor Faraday did not find volatilizable in the air might become so when left under the void of an air-pump; particularly if the heat were only elevated to 98°; for all matter requires some degree of heat to enable it to move. Brought down to zero there will be no more motion in inanimate, than animate *solids* and *fluids*. How far this might be the case with *gases* as regards their "diffusive power," seems to deserve experiment. Analogy is in favour of the motion ceasing or much diminishing under such circumstances, since heat obviously increases their tendency to move. So does *a void*, as we have observed further on in the text. Hence it seems probable that gases follow the law of solids and fluids in requiring a certain degree of heat to enable their particles to move. Is not heat the moving power in all these cases, and have not gases the greatest tendency to motion, because they contain most heat? And is not the motion of living matter chiefly dependant on life being a power capable of arranging matter, so that its temperature is maintained somewhat above the surrounding medium? Then if we adopt the theory of inherent activity, we shall also have less difficulty in explaining, why, when certain saline solutions are left to evaporate spontaneously the saline mass adhering to the sides of the vessel, gradually moves upward, beyond the original boundary of the solution. Nevertheless, I do not say that by this fact only we can explain this singular phenomenon. The reader who wishes to investigate this matter in detail, may consult the Memoir of Fusinieri in the Italian Journal of *Natural Philosophy*, That it is a *fact* I have satisfied myself by direct experiment. Capillary attraction also is probably, in part at least, owing to the same cause. The fluid rises in capillary tubes, probably because owing to the minuteness of the calibre, the air cannot press so effectually on the fluid as on those of larger dimensions; so that it is placed in some degree, as it were, *in a void;* and in consequence will have an encreased tendency to move. Nevertheless, the attraction between the fluid and the tube may influence this motion.

but moves far out of the vessel—in common language, evaporates. Such motion then, seems rather to have the character of inherent tendency to motion, than of mere dilatation from the removal of pressure, since no heat is applied to assist the evaporation, and gravity operates just as much *in vacuo* as in the open air. Gravity alone, then, is insufficient to restrain the tendency to motion in fluids. But even adopting the idea that the water, in the case just mentioned, moves from a mere mechanical power of dilatation, we are still brought back to the view which this essay takes of particles of matter freed from the restraint of cohesion or pressure, viz.: that their state is one of inherent activity. As it is evaporation *in vacuo*, on which I chiefly insist, as a proof of the inherent tendency to motion in fluids, it becomes right in this place, not to pass over a fact on this subject that may bear a construction unfavourable to such theory. "We are indebted, says Professor Graham," to Dr. Dalton, for the discovery that the evaporation of water has the same limit in air as in a vacuum. The quantity of vapour from a volatile body which can rise into confined space, is exactly the same, whether that space be a vacuum, or already filled with any air or gas in any state of rarefaction or condensation." Now, although it appears to me there are very strong reasons for doubting whether this point can be said to be established, I shall in deference to so profound a philosopher as Dr. Dalton, consider it established and attempt to show, that even such a view of the subject, is not incompatible with the theory of inherent activity of fluids when *in vacuo*. Experiments to be detailed presently, will sufficiently evince that the tendency to motion contrary to gravity in a fluid, *left entirely to itself*, is *far less* than in a gas; also that the expansive power of gases and vapours is much greater than that of fluids, at the same temperatures. Even in a void, then, the particles of a fluid will manifest, comparatively, but slight power of motion. Evaporation in consequence may possibly become limited, even to the extent Dr. Dalton conceives his experiments authorise him to conclude that it does; for we may imagine that when once vapour is formed in *a void, it will tend to expand itself much more than it does in air*, and consequently, *filling a large portion of space*, will come to press with sufficient force on the water in the void to prevent further evaporation, than would have taken place in the air. This supposition seems perfectly reasonable, when we consider the very slight power of motion that fluids, compared with gases, exhibit. Or, should this theory be untenable, then we may conceive that vapour produced *in vacuo* has not sufficient force to fill a large void *equally;* and in consequence, that the greater part not rising far beyond the vessel containing it, presses so much the more forcibly on the surface of the fluid exposed under the void, and thus soon puts a stop to further evaporation. On both theories, then, we see that by the supposition of pressure, we can account for the fact (if such it be) mentioned by Dr. Dalton. Taking any view of the subject we may, it is clear that fluids have *some* power of motion *in vacuo* (since there is always some evaporation;) if we admit Dr. Dalton's views as established we must of course admit the power of motion to be less, than otherwise might have been supposed; though, as we shall presently see, the power of motion in fluids contrary to gravity, is very slight. I have thought it right to allude to this point to show, *that on any theory*, fluids when unrestrained by pressure seem to possess an inherent power of motion.

I shall now proceed to say a few words on Endosmose and Exormose, and then pass on to relate a few experiments (already alluded to) with light fluids placed on heavier ones. The motion of fluid that takes place in Endosmose, cannot be regarded as furnishing so strong an argument in favor of the inherent activity of fluids, as the case of evaporation *in vacuo* just stated; because in Endosmose although the fluid may rise in some degree by its own powers, still it is evident that it is put in motion *principally* by the septum, and the other fluid. Nevertheless, Endosmose seems to furnish an auxiliary argument in favor of the power in question; since it seems to show there must be a disposition to motion in the fluid, or it would not be made to move by such slight causes.

As I conceive it right to state both sides of the question impartially, the following experiments made by me are sub-

joined. Müller says in his Physiology, if water be poured very gradually and carefully on a solution of salt, the salt water nevertheless still gradually mixes with the fresh. Much depends on the manner in which this experiment is made. If a wine glass, or even very narrow precipitating glass be used, the supernatant fluid being tasted twelve hours afterwards will be found *slightly salt*, but still not nearly so salt as the bottom fluid, as is evident by shaking them together. But if the same experiment be made in a test tube, in which case alone admixture of the fluids *at the outset* is best prevented, the supernatant fluid will be found even after twenty hours has elapsed, to be perfectly free from all saltness of taste, and even the slightest shade of color; at least this was the case when the solution of salt was colored red previous to being put in the tube. Nor even when this tube was heated for an hour to near 200° (by being immersed in boiling water) did the water become red or acquire a salt taste. The same was the case when a saturated solution of sugar (colored yellow) had an equal quantity of water poured upon it. Neither did the heat of boiling water cause the slightest admixture in this case. When port wine was poured in like manner on water in tubes, the water at the bottom remained clear and uncolored for sixteen hours; but when the tube was put in boiling water, the mixture soon became uniformly red. Whether this arose from the rapid evaporation of some of the spirit, when the tubes were immersed in boiling water, which implying expansion and motion agitated the water, I did not inquire; but as on ether being poured on a solution of gold in nitromuriatic acid, the gold gradually rises into the ether and colors it yellow, the probability seems to be that evaporation has some effect in causing the mixture of fluids, even in opposition to gravity; particularly when we find that neither salt nor sugar is made to mix with water more easily by such process, water not being so volatile as alcohol or ether.

These experiments shew that in ordinary circumstances, under the ordinary pressure of the air, and when evaporation is prevented as much as possible, there is little or no motion of fluids or of solids *dissolved or suspended* in them contrary to gravity; so that Müller in some degree seems to have mistaken the point.* There may be, however, and probably is, after Mr. Brown's observations, constant motion in such fluids, not in opposition to gravity.

Another conclusion to be drawn from these experiments (at least if Dutrochet's experiments were carefully made) is, that a septum is the principal, if not sole cause of Endosmose (as already observed.) When, says he, two parts of sugar, and one of oxalic acid were dissolved in sixteen parts of water, and the Endosmometer containing water only was plunged in this mixture, *no rise of the fluid took place* in two hours; but by tests it was evident that much oxalic acid had passed.§

Before finishing these remarks on the motion of fluids, I shall allude to one or two points in reference to the motion of the blood.

That the *void* produced by the motions of the heart, aided by the heat of the body (98°) will tend to facilitate the circulation of the blood, there can be little doubt. Will not such a condition, it may be asked, when we consider the influence of a void on fluids generally, particularly in combination with heat, tend to give the blood a power of mov-

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* We say in some degree, for Müller has not stated the time that must elapse before the admixture takes place. It is possible even in test tubes that after a few weeks the fluids might become mixed; and in glasses with a larger surface exposed to the air, *before* this period, in consequence of motion produced *by evaporation*. But that there is little or no motion *contrary to gravity* without the aid of evaporation, is clear from all the experiments just detailed.

I shall here relate an experiment made since the above was written, favouring the opinion that there is some little motion in fluids contrary to gravity. This is shown by putting some salt into a test tube, filling the tube with water, and letting it remain unshaken a week. In such a case I found that the fluid *at the surface* of a tube about four inches long that had been filled about one fifth part with salt, had a very salt taste. When, however, the length of the tube was nearly doubled, the fluid *at the surface* was not salt to the taste, even after the interval of a week. These experiments might be repeated with greater nicety by using tests.

§ Dutrochet's last Memoir on Endosmosis. This experiment, of course, shows there is a difference between a dense fluid merely diffusing itself through a lighter one placed above it, (which is nevertheless, a peculiar kind of motion contrary to gravity,) and the motion which takes place in Endosmosis. For this motion of Endosmosis, it seems always, or nearly always essential that the heavier fluid should be placed above the lighter one in the Endosmometer. In the case just mentioned the usual order was reversed, and we find there was no motion.

er se? By this, I by no means
to deny that its motion may be ma-
y assisted, or almost completely
ned by the contractile and elastic
s of the heart and arteries; but I
that when so many observers, as
ramus, Carus, Doellinger, Oester-
r, and Keilmeyer, have adopted,
e most part from direct microsco-
bservation, the opinion that the
has spontaneous power (if such it
be called) of motion, we should not
y reject such opinion. Müller, al-
g the existence of such motion, at-
es it to evaporation; but the com-
ment of organization in the seed
gg, would lead us to regard such a
, *per se*, of motion in the blood, as
means improbable. For surely in
these cases, the fluids must begin
ve before the vessels are formed;
it is the vital principle inherent ‡
fluids, by which such vessels are
d. The heat of incubation pro-
a motion in the fluids, and enables
carbonic acid to escape, (as the
will find alluded to more particu-
ereafter in reference to respiration)
in fact as it tends to act on in-
te matter. The fluids so put in
n, freed from carbonic acid, and
d still further by oxygen,—arrange
elves so as to form membranes and
s. There can be little doubt that
rticles of albumen are put in motion
vessels are formed. So, that whe-
y the microscope the *blood* may or
ot be seen to move before the heart
e chick be formed, (on which sub-
different observers differ) matters
for if the colorless fluids in the
s must surely be the case) can be
motion by the slight heat of incu-
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les of blood (as being far more vi-
l would be actuated in like manner,
sing as is probable, they are formed
the heart begins to beat.
us now examine gases in refer-
o this power of motion; and first
left in contact with each other,
Dalton, as is well known, has
d that when a bottle containing
nic acid gas, is connected by a tube with one containing hydrogen, and the latter placed at the top, the two gases notwithstanding the difference in density, gradually became mixed.

As two gases are here in contact, we might conceive it *possible* that the hydrogen gas had a power either of raising up, or tending to raise up, the carbonic acid. But that even the contrary of this is the case, the whole of the following observations will sufficiently evince.

In the "Annals of Philosophy" (May, 1834), Mr. Thompson has shown that professor Graham's law applies, whether we consider the gases to rise into each other or into a void, and certainly the particles of gases do act in one respect as a void, being *so far separate*. Nevertheless they oppose *some resistance to each other's motion; for, while a bladder of air put in vacuo bursts almost immediately the exhaustion is made*, I found that when bottles of oxygen and nitrogen were connected by a tube (the nitrogen being in the bottom vessel) that after an interval of three hours, the flame of a candle put in this vessel was extinguished, but, that after an interval of 48 hours a candle burnt in each vessel with equal brilliancy. This experiment along with others shows that the motion of a gas, in a direction contrary to gravity, is *much quicker* in a void than between the particles of another gas. Therefore, as the other gas does not assist, but retards the motion in question, the opinion that motion in these cases arises from an inherent tendency to motion, *as an essential property of the atoms of matter*, seems an adequate explanation. Professor Graham's experiments support the same inference, viz., that the presence of one gas offers *some* resistance to the motion of the gas in juxta position to it; "for," says he, "air enters into a diffusion tube with volocities denoted by the following numbers: 1276, 623, 302, according as the diffusion tube is filled with hydrogen, with carbonic acid or chlorine gas."—(Elements, p. 76). On this ground it seems to be *principally* that he considers Dr. Dalton's ingenious theory defective. "Something more, therefore," he continues, "must be assumed than that gases are *vacua* to each other, in order to explain the whole phenomena observed in diffusion." I leave it for philosophers to decide upon the adequacy

‡ is equally the case, whether we suppose the
inciple to depend for its existence on the
ition of the egg or seed, or to be a dis-
wer.

of the present theory. That gases even alone, and not in contact with others, have an inherent power of motion, is shown by the following observations and experiments:—(1.) When common water is placed under the receiver of an air pump, air and carbonic acid escape from it long before the ebullition or motion of the water begins. (2.) Again, water at 46° was *gently* heated. On coming to 56° only, bubbles of air began to appear, and at 70° became very numerous; and it appears highly probable that almost all the air may be driven off from water, if it be kept long enough* at 98° or 100°. Now, although heat itself tends to produce motion in fluids and gases, still as the heat applied was so very low in the case just mentioned (it need not be above 60° to produce the motion in question), this experiment is almost as satisfactory as the one alluded to before it, to show that gases *per se* have an inherent tendency to motion. (3.) Again, a bladder full of air soon bursts when put *in vacuo*, certainly from no other power than the motion of the confined particles of air, now the obstacle of external pressure is removed. Nothing can show more clearly than this familiar experiment, that the particles of gases (for a bladder of gas may be substituted for the air) are possessed of an inherent tendency to motion. Indeed this is so obvious, that had I not attempted to use this fact in explanation of their "*diffusive power*," I should not have ventured to have written this essay. The evidence that the same power existed likewise in solids and fluids (particularly the latter) required some deeper attention to render it obvious.

Let us now consider what may at first sight be deemed an objection to the opinion—that one gas does not raise the other by a specific power. I allude particularly to the carbonic acid existing in the blood. After the experiments of Stevens and Magnus, it is clear that by agitating blood with hydrogen gas, carbonic acid may be taken away; but there has been a doubt with some physiologists whether this gas can be removed from the blood by the air-pump. Magnus, however, says, Müller, in his Physiology, "has found on repeated experiments, that a perceptible quantity of carbonic acid is not given out until the air in which the blood is placed is so rarefied that it supports only one inch of mercury. This, he continues, explains why former observers have obtained an opposite result." The difficulty, then, seems still to remain, that carbonic acid gas is never so easily removed from blood by means of the air pump, as from water. We would explain this difficulty by supposing either that the *thickness* of the blood, or the alkali it contains, tends to prevent the escape of the gas in question; or that blood has a greater affinity for carbonic acid than water has. All these causes may conspire to impede the escape of the gas. So that even in this case, we are by no means justified in presuming that a light gas has a specific power of raising a heavier one. All is explicable (as in the case of carbonic acid dissolved in water) by supposing an *innate power of motion in the gas itself*: though in the case of blood, opposed by another force, or forces. Nevertheless, we do not presume to say, that one gas, by its presence, may not influence the motions of another; but this is a different thing from actually causing them.

On referring to the experiment (No. 1), with water under the receiver of the air-pump, it will be perceived that air and gaseous matter generally, shows a much greater tendency to motion than fluids do. In the void, equally as under the influence of the lowest degrees of heat, gases begin to move before the fluids* holding them in solution. And

* I say long enough, because I found that, although this same water was kept at between 100° and 130° for nearly two hours, that on being raised to 180°, many more bubbles were produced, no doubt air or gaseous matter detained by a stronger affinity, as being the last portions. The very low temperature at which the greater quantity, if not the whole of the air in water passes off, is singular in reference to respiration. That the heat of the body is sufficient to favour the escape of carbonic acid gas from the blood, can scarcely, after the above experiments, be doubted; and even allowing that air will extract some carbonic acid from blood, at a lower temperature than that of the body, just as water begins to give off air when raised to near 60°; still, as it obviously gives off such air more copiously at between 90° and 100°, so the heat of 98° may still be absolutely necessary to enable a *sufficient quantity* of carbonic acid to pass off from the circulating system. This, therefore, is probably, one *of the modes in which the heat of 98° is necessary for the maintenance of life among the higher classes of animals.*

* I have regarded evaporation *in vacuo* as the clearest mark that fluids have a tendency to motion contrary to gravity. But if, in this case, it is a

we have already seen, that some different fluids may be kept in contact for 18 or 20 hours, and probably much longer, without showing *any* tendency to move towards each other. Now, in like circumstances, the mixture of gases is probably always thoroughly completed in six or eight hours.

Again, take what may be called the endosmosis of gases, and compare it with that of fluids, and we shall find the same increased tendency to motion conspicuous. "Within twenty minutes," says Professor Graham, "all the hydrogen, from a diffusion tube six inches long filled with it, will be found to have passed through the minute pores of the stucco, and have its place partially filled by air."* No celerity of motion like this has, I believe, ever been observed in experiments on the endosmosis of fluids, whether the septum were of bladder, vegetable membrane, or any other material. Besides, there seems few, if any cases of the endosmosis of fluids where the heavy fluid rises above the light one; carbonic acid rises through hydrogen with facility, even without a septum. Again, by equal degrees of heat, gases expand much more than fluids, and fluids than solids, as is well illustrated in Graham's Elements (p. 11), by the relative expansion of iron, water, and air, heated to 212°. Although, as was to be expected, water expands more than iron in such circumstances, still, it bears no proportion to the vast expansion of air under the like circumstances.

From all the above considerations, then, it is sufficiently clear that the inherent tendency to motion is much greater in gases than in fluids, and in fluids than in solids; for, with a few exceptions, Professor Faraday did not find that solids, either in mass or solution, evaporate or sublime at common temperatures, as we know water does.

We may now go further, and state, that the lighter the gas or matter, the greater, *generally speaking*, is its tendency to inherent activity. Ether moves (evaporates) more quickly than alcohol, and alcohol than water. It seems the same with gases. Thus, says Professor Graham, "the lighter gases diffuse or escape most rapidly." Hydrogen, also, was found by the same experimentalist, to pass through stucco into *a void* more quickly than the other gases.

But the tendency to motion is still greater in light, heat, or electricity (if light and heat be not material) than in hydrogen; and in mind and in the vital principle, even than in electricity.

My opinions on the present subject in reference to solids, fluids, and gases, may be summed up in these words.

The particles of solids, as an essential principle of their nature, have a *tendency* to motion when unrestrained by cohesion or other forces.

The particles of fluids have likewise this tendency; but in both such cases the power is so weak that it requires the removal of atmospheric pressure* or some other exciting cause, to enable it to exert itself to any extent contrary to gravity.

Thus we have already observed that a colored saturated solution of salt being poured into a *tube* with water above it, remained 20 hours without mixing in the slightest degree with the saline so-

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vapour that moves, why, then, I should say, there seems little evidence at present, that fluids, *strictly so called*, have, *per se*, a power of motion to any extent. But as the fluid must probably move *per se* before it changes into vapour, I must still regard fluids *in vacuo* as, *per se*, possessing inherent activity.

* Elements of Chemistry, p. 73.—Judging from this experiment, a *septum* of stucco would appear to hasten the motion of the gases; for I certainly found they had not thoroughly mixed when connected by a tube (as in Dalton's experiment) in three hours; in fluids a septum would appear not only to hasten, but in most cases to be essential to motion. Dutrochet has shown, in his last Memoir on Endosmosis, that the material of which the septum is composed influences the extent and direction of the motion, since different fluids can pass more readily through different septa. Nevertheless, how a septum acts in *causing* this motion of fluids (for a septum, generally speaking, seems essential to the motion of fluids in juxta-position, though not of gases), he considers, after all his very ingenious experiments, involved in mystery. Not only would a septum appear to hasten this motion of gases, but also to prevent that mixture which takes place when two bottles of different gases are connected by a tube. Probably, however, if the stucco were so placed as to limit the quantity of *external air* in the same way as the quantity of hydrogen was limited, the tube would contain a *mixture* of the gases, and not air only, as it seems to have done in the experiment above-mentioned.

* Although water not in a void evaporates at the ordinary temperature of the air, still such evaporation is very slow; and it seems doubtful how far such phenomenon may depend on the dryness of the air, by which means the fluid is rather borne up by a power foreign, than one essential to itself. At all events two causes here probably combine to raise it up; the air, as well as its own tendency to motion. In consequence, as a *general principle*, it may be stated, that fluids must be in a void, before we can unequivocally pronounce, that they can move solely by their own power.

lution, as was proved not only by the color but by the taste of the supernatant water remaining unchanged. The saline solution then in this case could not have moved *contrary to gravity*, or it would have risen up and mixed with the water. It may, however, have been in a state of constant motion (as Mr. Brown's experiments would lead us to believe), in its own particles (motion not in opposition to gravity.)

Different is the case with gases. Not only is there in them a tendency to motion, but the facts and experiments detailed show that their particles are in a state of constant motion *contrary to gravity*, and independent of any existing cause, such as a septum, which in the case of fluids is often almost adequate to produce motion in opposition to gravity.† We say motion in opposition to gravity, not because a heavier fluid rises through a light one, (for, as already observed, it seems almost if not always, necessary for the production of endesmosis, that the lightest fluid should be below or external to the other;) but because the light fluid rises in opposition to the pressure of the air. Of course the power of motion is much stronger in gases than in fluids or solids. And that it really exists in gases, and is the cause of their diffusive power, seems clear, not only from what has already been said, but also from the fact that the carbonic acid does not rise *above* the hydrogen and *remain unmixed with it*. This would have been a more singular phenomenon, doubtless; but I do not think so well calculated to show that inherent activity even contrary to gravity, is an essential property of gaseous matter; for had the carbonic acid remained at the top it might have been asked, *what power keeps it there*, supposing inherent activity to be an essential property of gaseous matter?* But as we find when it has arrived at the top of the vessel it does not remain motionless but diffuses itself; we here again seem to have another argument (though weaker than some of the foregoing,) in favour of the conclusion that inherent activity even contrary to gravity, is an essential property of gaseous matter.

I shall conclude this paper by an attempt to apply some of the preceding views in explanation of the constant motion of the earth. According to received opinions, the earth seems supposed to move in a void, or in an etherial fluid of little or no density whatever. Now, may not the earth in such circumstances be regarded in the light of a portion of matter *in a void?* And although, doubtless much larger than an atom, still may it not be considered as governed by the same laws? This seems almost certain; and as we have found that fluids, and even solids, *in vacuo*, tend to constant motion, we have reason to believe that such will of necessity be the tendency of the earth.

It seems probable, therefore, that in a void alone even without heat the earth would have a tendency to motion. But it is obvious that heat will much increase this tendency. Now this seems the condition of the earth. Besides being in a void, or an imponderable fluid, it is also heated by the sun. And astronomers inform us, *not only that the planets move faster the nearer they are to the sun, but also that the same planet moves quicker in like circumstances*.

The sun, therefore, seems in some way or another evidently connected with the quickness of the earth's motion. Will not its heat tend to repel, *in proportion* as its gravity tends to attract? And is it not from these powers being necessarily balanced, that the earth tends not to fall into the sun? The nearer a planet is to the sun the greater is the attraction of gravitation: but *in like proportion* also is the heat greater—the repulsive energy.

It seems not improbable, therefore, that the sun is not only the cause of the quickness of the earth's motion (the first impulse to which is produced by its being in a void,) but also of this same planet moving in the orbit it does.†

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† Possibly the reason why gases, commonly speaking, are in a state of motion in *opposition to gravity*, while fluids are not, is partly because the atmosphere cannot press with so much effect on them, and thus restrain their motion, as on fluids.

* However, on further reflection, I would not insist, *beyond a certain extent*, on this view; because it might be said the gas will tend to descend in virtue of its superior gravity; and *in a degree* this may be the case. But only in a degree, for gravity does *not appear to* have the power to make a gas descend *so unequivocally* as a solid or a fluid. (*Subsequent note.*)

† However the constancy of the motion *in the same direction* seems still to remain unexplained in adopting this view. On this point I do not pre-

I am aware that this theory will for the most part render the supposition of a centrifugal force, (as such force is generally understood) unnecessary; but if there is not (as appears to me to be the case) such strong evidence for the existence in Nature of this force, as of those just mentioned, I apprehend the present theory will have an advantage over the old one. But on this point I merely hazard a conjecture, of the value of which the astronomer will be the best able to decide.

I shall be satisfied, if in the preceding remarks I have really contributed to elucidate the nature of motion in the *atoms* of matter; I can scarcely expect the theory herein proposed to be equally successful when applied to the motion of *worlds*.

ON THE NAVIGATION OF THE AIR AND WATER.

Sir,—Two new schemes have been broached this week which seem destined to make some sensation in the world of science—one for aerial navigation, by my namesake, Mr. Green, and the other for a new mode of propelling vessels by steam, mentioned in one of the weekly journals* as being in the course of successful trial, but the details of which have not, as yet, been fully developed; it is, however, easy to see that they both depend upon the same principle or mode of action; viz., the production of a progressive motion in the balloon, or vessel, by the successive creation of new *vacua* immediately before it, and the filling of the old ones left behind it, with the fluid conveyed from the former to the latter by the most direct course possible. I proposed this as the only feasible means of propelling a balloon through the air, to the late Mr. Egg, of Pall Mall and Knightsbridge Green, in February, 1816, soon after his quarrel with his coadjutor, Mr. Pauly, had brought the works upon his monster balloon, then constructing at Knightsbridge, to a stand still. This machine was to be in the shape of an immense fish, "to be steered at pleasure, similar to vessels at sea, in an horizontal or vertical direction, without losing either gas or ballast." On the first day of its ascension it was to go a circuit round London, and to return to the place of starting. My plan was to fix a tube along the under part of his fish, through which the atmospheric air was to be drawn in at the head and forced out near the tail, by the action of a fan-wheel like that in a winnowing machine. It is easy to see that this must have had the effect of impelling the balloon in the direction of that end of the tube into which the air was forced or drawn, and that it might then be steered with a rudder; but then it is doubtful whether it could be rendered effectively available for going against the wind, or with any useful velocity in a still atmosphere, as a balloon must necessarily be made of frail materials for the sake of lightness, and hence, even if we had the power of pulling it along as we pleased, it would be torn to pieces by the resistance it would have to encounter. This, however, was not Mr. Egg's opinion, as he professed to make light of the difficulty of making his balloon go where he pleased; but it was never finished, although he had spent, as he told me, above 4000*l.* upon it and his *folly*, as he called the large building erected on purpose for it on the spot where Wilton-place now stands. This singular man also declared that he thought nothing of being able to fly—he was sure he could accomplish it, if it was worth his while to try—what was it?—even the silliest of birds, he said, could do it; yet he was but a *goose* after all!

It has always appeared to me that the plan above-mentioned was the simplest means that could be devised for the application of the power of steam to the purposes of navigation. A ship in the water fills up a hole in it equal in magnitude to that part of her bulk that lies below the surface of the fluid, and it is impossible that she can move out of that hole without making another one, of equal size, in another part of the water.

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sume to hazard a conjecture, as I leave the details of the present theory to be filled up by enquirers who devote their time more especially to physics and astronomy. If there be a difficulty in the present theory, there seem to be two others in the old theory of a centrifugal force. For, first, we seem obliged to conceive that this power diminishes as the distance of the planets from the sun diminishes; and, secondly, that it likewise diminishes in proportion as the *same* planet is further from the sun. But, surely both these opinions have little foundation *in experiment;* nor on the old theory, of a centrifugal force, can we assign a *physical* cause for such phenomena.

* *See Notes and Notices, p. 527.*

which other hole ought, in order to have no waste of power, to be filled up with the fluid that comes out of the first one. Now, which is the readiest way to dig the new hole and to fill up the old one? Not, surely, to make two other holes, by the side of the first one, in order that the water by running into these may make a fresh hole for the ship to fall into, and may afterwards pass on to fill up the cavity that she has left behind, as is clumsily done with a pair of paddle-wheels; for in doing so this immense power will be lost in making holes where they are not at all wanted. The easiest way is, obviously, to take the materials immediately from the place where the cavity is wanted, and so pass them at once by a channel made through the body of the vessel to the stern, where being forced up into a heap they compel her to fall into the place prepared for her. In this way there can be no tumbling in from the sides, nor from any part but the very place into which it is wanted to put the ship, and thus the least possible power is required. The effect may probably be increased by making the stern of the vessel a little concave that it may the better retain the water thrown out by the power of the fan-wheel. This amounts in fact to the causing of the vessel, as it were, to be continually sliding down hill. An iron tube of a diameter proportionate to the size of the vessel, and passing through the hold, from stem to stern, whilst it got rid of the clumsy excrescences of paddle-boxes, would not occupy any considerable space. It is not a matter of necessity that it should be quite straight, although, of course, the straighter it is the better. But a main point is, that its exit and entrance should be sufficiently deep in the water, and that both should be in the plane of the keel. The screw or fan-wheel may be placed in a box through which a vertical or horizontal shaft, packed water-tight, may be passed to work it from within any part of the vessel, fore, aft, or amidships, as may be found most convenient, and thus the engine need no longer occupy all the best part of the ship, and the whole apparatus being below water will have the best possible protection from external dangers. It *remains to* be seen whether it will be *necessary* to prevent the tube from "catching too many fish," by defending its mouth with some sort of a grating to keep out "the monsters of the deep." It is easy to see, that, if all the water displaced by the motion of the vessel, or the action of her machinery, were to pass through this channel, there must be a quantity equal to her tonnage run through every time she made an advance equal to her length; but, no doubt, a good deal would still flow round her bows; this point, however, and many others, must be left to be determined by experience. It is unnecessary to dwell on the possibility of reversing the motion, as this may be obviously done in many ways.

I am, &c.

Wm. Green.

Knightsbridge, March 31, 1840.

HALL'S (CHILD'S) PATENT HYDRAULIC BELT.

Sir, — Sir, I perceive that "Hall's Hydraulic Belt" has at length been noticed in your Magazine, where its merits have every chance of being fairly discussed.

When I first heard of it, it struck me that it was an old acquaintance, and that I had observed something extremely like it, even in your own Magazine, several years back. On reference accordingly, I find the following description in the *Mechanics' Magazine*, vol. vii., page 445; it is so concise that I shall take the liberty of transcribing it.

"The *Rope Pump* consists of two, three, or more hair ropes passing over pulleys; the one at the top, the other at the bottom of the well. The ropes are not more than an inch apart; and, when the pulleys are made to revolve, they carry up with them a column of water which is deposited in a reservoir at the top.

"A pump of this kind has been made to raise, by the efforts of one man, about nine gallons of water in a minute, from a 95 feet deep."

This description was published in your Magazine for July, 1827; not as any thing new, but in common with other well known machines in a familiar treatise on hydraulics. It is to be regretted that the writer did not quote his authority, particularly for the concluding statement, which is valuable as a comparison.

In August, 1834, seven years after-

wards, a patent was granted to Mr. Child for the present hydraulic belt; and from him, I presume, it was subsequently purchased by its present proprietors, Messrs. Hall.

The only distinction between the machine just described, and the patent hydraulic belt, is, the employment, in the latter, of a cloth fabric, instead of a series of ropes: but in what does a cloth fabric consist, if not in a series of ropes, or threads, bound together? Moreover, I doubt very much, whether this "distinction without a difference" is, after all, an improvement: because, in the cloth fabric, the ascending column of water adheres by one side only; whereas, the ropes, by means of their interstices, support a series of columns on two sides.

"Indicus," who, at page 445 of your last number, details the results of two experiments with "Hall's Hydraulic Belt," appears to me (if I wrong him I regret it) to be a disguised friend to the patent, who seeks not to "damn by faint praise," but to praise by faintly condemning. Who would not imagine from the first glance at the experiments, that the second (chosen by "Indicus" for calculation) was the most favourable to the machine?—particularly as it is stated that "the machine was in the second trial, allowed to get into full play before checking its work? But what is the fact? Why, that the duty done by the machine on the first trial comes marvellously near to what it had been represented as capable of; while, in the second, it disappointed "Indicus" by falling short of such representation by 15 per cent., viz.:—

	Pressure.	Effective power.	Duty.	Rate per Ct.
1st trial, …	30lbs.	70,000lbs.	58,955lbs.	84
2nd trial,…	35lbs.	90,000lbs	66755lbs.	74

The choice of the least favourable effect has very much the appearance of having been designed to leave an opportunity to some *other friend* of the machine, of triumphantly correcting "Indicus's" calculation and proving that the *represented* performance had not been overrated.

But supposing the duty of the Patent Hydraulic Belt is fully as much as represented, viz.:—87 per cent., it is not, even then, a whit better than the poor old *rope pump* before described, whose performance was 8550 lbs. raised one foot in one minute by a single man; nor can it be compared with Shalder's pump, which, *according to its proprietor*, is capable of returning every pound of power that it receives, or 100 per cent.!!!

NAUTILUS.

24th March, 1840.

DEMONSTRATION OF RULE FOR TAKING LUNAR OBSERVATIONS.

Sir,—Your nautical correspondent Mr. Watchwell, is, no doubt, taking a proper method of attaining a *solid knowledge* in the science of nautical astronomy; he states, (No. 862) "that he has of late devoted himself to the study of spherical trigonometry." This is all right, provided he has previously attained a competent knowledge of the elements of geometry, also the elements and analytical method of plane trigonometry, and lastly, a knowledge of algebra as far as equations of the 1st and 2nd order. If such be the case, then he, or any other of a persevering disposition may soon attain sufficient knowledge of astronomy for all the purposes of navigation.

The following investigation, cannot, perhaps, boast of any claims to originality: indeed this subject has been so often explored by first-rate mathematicians, that very little new on the matter can be expected. My chief object in what follows is to render the subject as simple as possible, and going a little more into detail than I believe is generally done, I trust Mr. Watchwell will find no difficulty in understanding the following investigation.

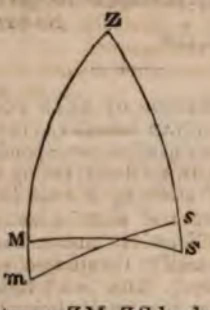
I must again premise that it is expected that he is acquainted with the method (and understands the principles) of expanding the sines and cosines of the compound arcs $[(A \pm B) \pm C]$ into the sines and cosines of the simple arcs; also if A, B, C, be the three angles of a spherical triangle, and a, b, c, the opposite sides, then

$$\cos. A = \frac{\cos. a - \cos. b, \cos. c}{\sin. b, \sin. c};$$

also, how to manage an equation of the 1st order, and that parallax has the effect of diminishing the altitude of a celestial body and refraction increasing it, these are the particular requisites that will render the following process easily understood.

Let M represent the true place of the moon m, her apparent place; S and s the

true and apparent place of the sun, or a star, z the zenith, and draw the great circles as in the diagram. Let the true



zenith distances Z M, Z S be denoted by z and z', and the apparent altitudes by a and a', then $z\,m$ and $z\,s$ will be the compliments of the altitudes a and a'. Lastly: let d and d' denote the true and apparent central distances M S, $m\,s$. Then the object of the problem is to find the value of d in terms of a, a', z, z' and d'.

By the above stated spherical theorem, we have, cos. M Z S =

$$\frac{\cos. MS - \cos. MZ . \cos. SZ}{\sin. MZ . \sin. SZ} = \frac{\cos. d - \cos. Z . \cos. Z'}{\sin. Z . \sin. Z'},$$

and cos. $m\,z\,s$

$$= \frac{\cos. ms: - \cos. mz . \cos. sm}{\sin. mz . \sin. sm} = \frac{\cos. d' - \sin. a . \sin. a'}{\cos. a . \cos. a'};$$

consequently,

$$\frac{\cos. d - \cos. z . \cos. z'}{\sin. z . \sin. z'} + 1 = \frac{\cos. d' - \sin. a . \sin. a}{\cos. a . \cos. a'} + 1.$$

Hence,

$$\frac{\cos. d - (\cos. z . \cos. z' - \sin. z . \sin. z')}{\sin. z . \sin. z'} = \frac{\cos. d' + (\cos. a . \cos. a' - \sin. a . \sin. a')}{\cos. a . \cos. a'},$$

or

$$\frac{\cos. d - \cos. (z+z')}{\sin. z . \sin. z'} = \frac{\cos. d' + \cos. (a+a')}{\sin. a . \sin, a'} \therefore \cos. d = \cos. (z+z') + [\cos. (a+a') \cos. d'] \frac{\sin. z . \sin. z'}{\cos. a . \cos. a'};$$

assume,

$$\frac{\sin. z . \sin. z'}{\cos. a . \cos. a'} = 2 \cos. B$$

$$\therefore \cos. d = \cos. (z+z') + 2 \cos. (a+a') . \cos. B + 2 \cos. d' . \cos. B . . . . \quad (A)$$

$$\text{But } \cos. [(a+a') + B] = \cos. (a+a') . \cos. B - \sin. (a+a') \sin. B$$

$$\text{and } \cos. [(a+a') - B) = \cos. (a+a') . \cos. B + \sin. (a+a') . \sin. B$$

$$\therefore \cos. (a+a'+B) + \cos. (a+a'-B) = 2 \cos. (a+a') . \cos. B.$$

$$\text{Similarly, } \cos. (d'+B) + \cos. (d'-B) = 2 \cos. d' . \cos. \cos. B.$$

Hence, by substitution; equation (A) becomes

$$\cos. d = \cos. (z+z') + \cos. (a+a'+B) + \cos. (a+a'-B) + \cos. (d'+B) + \cos. (d'-B)$$

$$\text{and } 1 = 1 + 1 + 1 + 1 + 1 - 4$$

Hence, by subtraction,

$1 - \cos. d = 1 - \cos. (z+z') + 1 - \cos. (a+a'+B) + 1 - \cos. (a+a'-B) + 1 - \cos. (d'+B) + 1 - (\cos. d'-B) - 4$. But $1 - \cos. d = \text{vers. } d$. & $1 - (\cos. z. + z') = \text{vers. } (z+z')$ &c. Hence, $\text{vers. } d = \text{vers. } (z+z') + \text{vers. } (a+a'+B) + \text{vers. } (a+a'-B) + \text{vers. } (d'+B) + \text{vers. } (d'-B) - 4$,

and this is a demonstration of the rule which Mr. Watchwell requires. With regard to the auxiliary arc, B and some other remarks I may perhaps make on this subject, I shall reserve for another communication. In the mean time, if Mr. Watchwell should find any difficulty in any of the steps of the above investigation, I shall feel happy in endeavouring to remove them.

I am, Sir, yours, &c.

GEORGE SCOTT.

March 28, 1840.

N.B. By some mistake I dated my last letter Feb. 13, instead of March 13.

LOCOMOTIVE AEROSTATION.

We are glad to see the very interesting subject of steering balloons taken up practically under the auspices of Mr. Green, at the Polytechnic Institution, where a small model balloon is steered, elevated, or depressed by a screw propeller.

We would recall the attention of our readers to the essay on this subject by Sir George Cayley, Bart., published in

our number for March 4, 1837. This mode of propelling balloons on a large scale is there proposed, and all its details of calculation fully entered upon, together with almost every other subject bearing upon the steerage of balloons.

The small experiment exhibited at the Polytechnic Institution proves the efficacy of this principle of steerage, though attached to the *car* or near to it, which has been thought by some persons to be impracticable.

We hope that this interesting experiment will lead to a general effort by subscription to forward rational experiments on the subject, as proposed by Sir George Cayley in the essay alluded to. Mr. Green's scientific knowledge, strong nerve, and great experience renders any effort at the present time doubly valuable.

IMPROVED PRINTER'S COMPOSING STICK.

Sir,—Having been asked the questions, Would not the improved stick* be too heavy by the back being made stouter? and, If it could be made with a double slide? I beg to make known through the same medium, that its weight is very little more, if any.

I purpose the back to be one-eighth of an inch thick, which is about double to that of the old stick; but when the length of slide is diminished, and the opening in the back considered, which extends from the head to within one inch of the bottom, it will be seen the weight is no more than that of the common composing stick.

Respecting a double slide, it may easily be obtained, as seen by the following figure:—

The inner slide answers both purposes of slide and nut; the outer slide being similar to that of the common, but not more than two-thirds the length, corresponding exactly with the back, the tenon of the inner slide going through the outer, and again through the back, nearly on a level for the head of the screw to rest against.

Your much obliged servant,
J. H. LEWIS.

* See *Mech. Mag.* No. 864, p. 408.

MR. LAKER'S TREATISE ON THE USE OF THE SLIDING RULE.

Sir,—Some years since you and others* did me the honor to commend highly a small "Companion to the common Sliding Rule," of which, though printed for local use, a few copies came before the public. It was my intention to have brought out an enlarged edition for general sale, and the design though delayed was not abandoned.* Lately I discovered that Mr. John Laker, jun. had, in 1837, reprinted this little work, with additions, and *published it as his own*. An "advertisement" is prefixed, in which Mr. L. states that "those pages were originally intended for private reference only, but at the solicitation of several friends were *arranged* and published for general use;" and adds that "the plan of the work was *similar* to that of Mr. Woollgar, from whom also, and from Mr. Bevan, many of the formulæ had been borrowed." No one, I think, would from such an announcement, infer Mr. Laker's book to be a complete reprint of mine, with very slight occasional variations, and the interpolation of about 55 more formulæ. Yet such is the fact! Almost every line of explanatory matter, every table computed and arranged by my own hand, is transferred *verbatim et figuratim*.‡

However pleased I might otherwise have been to find the pen of Mr. Laker employed in facilitating the use of my favourite instrument, I could not under these circumstances avoid calling for a personal explanation. And Mr. L. at

* *Mech. Mag.* vol. x. p. 139.—xiii .52.
* *Mech. Mag.* vol. xiv. p. 42.
‡ Had Mr. Laker dealt with any book-publisher's work as with mine, an injunction from Chancery would speedily have taught him a wholesome lesson. I have known that course taken with respect to a work of less price than this. Mr. L. has nothing of the kind to fear from me. It would be "breaking a butterfly on the wheel."

once admitted that it was not his original intention to have brought out this work without my privity; but that he ultimately acceded to the opinion of others, who thought my consent unnecessary! Further correspondence, however, has shown me that Mr. L. like too many others, prefers the defence of an inadvertent fault to the making of an open confession.

I will do Mr. Laker the justice to say that his own additions are well made, and that probably the users of the slide rule are no sufferers by the circumstance of the new edition not being brought out, *at that date*, by myself. Were I now to publish, my views would embrace more of the theory, greater variety of construction, and a wider range of computation.

J. W. Woollgar.

Lewes, March 27, 1840.

ON MACHINE MADE PAPERS—REPLY TO MR. ENORT SMITH.

Sir,—I confess I am rather surprised that the communication of "Enort Smith" (p. 390), on "the disadvantages of machinery," illustrated by examples from "the paper trade," should have remained thus long unnoticed. The whole question is one of considerable importance, upon which many of your readers must be tolerably well informed. I had, therefore, expected that the fallacious arguments of Mr. Smith would, ere this, have been refuted.

Mr. Smith sets out with a self-evident and incontrovertible proposition, viz., that "machinery has its disadvantages as well as advantages." This he endeavours to prove by illustrations from the paper trade, and points out "two prominent defects in machine-made papers," but singularly enough, he himself shows that these "two prominent defects" originate, *not* with the *machinery*, but through "the carelessness or incompetency" of the workman, who causes one great defect (irregularity of substance) by his "oversight or ignorance;" and a second, by deceptive attempts to conceal the first. The other "prominent defect" is the injuring of the paper-fabric by too rapid drying, from *the employment of too high a temperature in the steam-cylinder.*

It is undoubtedly true that both these defects are occasionally met with in machine-made papers, but the machinery is not to blame for either; the cause is to be found in want of attention or want of skill in the artisan; and to bring forward these faults as proofs of "the disadvantages of machinery," is a fallacy of no ordinary magnitude, and one hardly expected to be found in the arguments of a reader of the *Mechanics' Magazine!*

Before the introduction of Fourdrinier's machine, in the high and palmy days of hand paper-making, where could a sheet of paper of the texture and quality which the reader now has before him, be procured for double its present cost? And what, let me ask, has contributed so much to the present wide diffusion of cheap and useful knowledge, as the improvements which have taken place in paper-making, by the employment of machinery?

In the process of making paper by hand, the workman takes the mould, and having placed upon it a frame with a raised edge, technically called a *deckel*, he dips it obliquely into the vat, to the depth of four or five inches. After the immersion he raises it to a level; by this means he takes up on the mould a proper quantity of stuff, and as soon as the mould is raised out of the vat, the superfluous pulp escapes over the sides of the *deckel*, while the water drains through the interstices of the mould. The fibrous particles of the pulp arrange themselves regularly on the mould, not only in proportion as the water escapes, but also as the workman favours this effect by gently shaking the mould. Altogether this is a very delicate operation, for if the mould be not held perfectly level, one part of the sheet will inevitably be thicker than another. To ensure uniformity of substance in the paper, the pulp must be kept of equal consistency and in constant agitation; the mould must be dipped to precisely the same depth in taking up each sheet, and must be held perfectly level in raising and shaking; without these points are strictly attended to, uniformity of substance cannot be obtained. As it is next to impossible that every hand-made sheet of paper should realise this perfection, the last process of all—*sorting*, becomes necessary. In this operation all the uneven sheets are laid aside: such as are

y defective are put on a pile of —the torn ones on the pile of , or *outsides*, while the good paper d of these defects is put together e market.

h the machine, to obtain uni- y of production, the pulp, as in rmer case, must be maintained of niform consistency; it must be tted to flow through an aperture efinite size, and must be kept at ame height in the vat or pulp- to ensure equality of pressure and y uniformity of discharge; the re velocities of the wire-cloth, and sue of the pulp must also be pre- l. Any variation in these matters to produce irregularity in the ance of the paper. These influ- , however, are for the most part control, and admit of a very nice tment; the manufacturer, there- who aims at producing superior ine-made papers, pays great atten- o these points, and the result is, a ifully even and uniform lot of pa- possessing as little irregularity in ass, and much less irregularity in eet, than hand-made papers.

henever from ignorance or rapa- a manufacturer puts up his paper s it comes off the machine, with- ttempting to separate into their re- ive classes the variable portions of naking, the irregularity mentioned Ir. E. Smith, will occur—the ex- of irregularity being more or less, oportion to the greater or less care ised by the workmen presiding the making. In the instance of the cartridge mentioned by Mr. Smith, he manufacturer sorted it into par- of 30 lbs., 34 lbs., and 38 lbs. per he would have found a ready sale ll these kinds—each one being re- d by different parties for different oses. The cost of *sorting* would been amply covered by the in- ed value of the paper. It is the lity of small manufacturers in has- g their goods into the market with- dopting those perfecting processes h long experience has shown to be ssary, that furnishes such grounds omplaint as is taken up by Mr. h. Take the papers of Dickinson, wick, Cowan, Brown, and several s, and show me, (if you can) hand- papers that will surpass them in rmity of substance! The fault then, when faults there be, is *not* in the *machinery*, but in the *workmen*. The most "indecent haste" of needy paper-makers to finish off their goods, "quick as lightning," leads to the second "prominent defect" complained of by Enort Smith, viz., using steam of so high a temperature in the drying cylinders as seriously to injure the textile fabric of the paper, and to make it full of wrinkles. This defect, however, is not very common, and rarely ever met with except in the cheapest class of small hand. But here again it is *not* the *machinery*, but its superintendent that is in fault.

With respect to machine-made papers generally, it must be admitted that in the article of printing papers of all kinds —cheap writing papers, hand papers, and cartridges—the introduction of machinery has effected a very great improvement in quality, as well as a great reduction in price. Take cartridge papers in particular, and show me a sheet of hand-made paper, either of ancient or modern manufacture, that can for one moment be put in comparison as to evenness of fabric, smoothness of surface, and absolute strength, with the machine-made cartridges of the present Scotch makers.

Dr. Ure, in his Dictionary of Arts and Manufactures, observes that, "nothing can place the advantage of the Fourdrinier machine in a stronger point of view than the fact of there being 280 of them now at work in the United Kingdom, making collectively 1600 miles of paper, of from 4 to 5 feet broad, every day; that they have lowered the price of paper 50 per cent., and that they have increased the revenue, directly and indirectly, by a sum of probably 400,000*l*. per annum."

I remain, Sir, yours respectfully,

WM. BADDELEY.

London, April 2, 1840.

ETHELSTON'S TABLE FOR MENTAL COMPUTATION.

Sir,—It surprises me that no notice has as yet been taken by any of your correspondents, whose province it more peculiarly is, of the table for ready reckoning presented to your Magazine by Mr. Ethelston, at page 348, vol. xxxii.*

* We have received several communications upon Mr. Ethelston's table, all condemning it as useless; but we waited for one in which its uselessness should at once and clearly be shown. Nautilus disposes of the matter completely.—ED. M. M.

I take it for granted that when any project of the kind is submitted to the readers of the *Mechanics' Magazine*, it is with a view to its becoming an object of criticism; and that if it be allowed to pass unnoticed, it is either because its correctness and usefulness are fully acknowledged, or that its pretensions are of so palpably absurd and humble a nature, as to render it safe from animadversion. In this latter predicament Mr. Ethelston's table would doubtless be were it not for the science and respectability of its sponsors; the statement that 24,000 copies had been bought up with avidity by the good folks of Manchester; the astounding parade of the titles and dignities of its inventor; and the inflated language in which he has chosen to describe it.

> "Carmina
> Vociferantur, et exponunt PRÆCLARA REPERTA;
> Ut vix humana videatur stirpe creatus."

These circumstances have conferred an importance upon the matter that it would not otherwise possess, and have induced me to pause for weeks under the idea that there must necessarily be in it some occult magical virtue that could not be discovered at a first examination. In these remarks, therefore, which in the absence of better I feel called upon to make, I need scarcely say that I intend no personal discourtesy either to its author or to its admirers, but merely to give expression to a surprise I really feel how anything so devoid of merit should have been hailed with a reception which throws that of Murphy's Almanac itself into shade.

The chief circumstance that the inventor seems to rely upon as conferring a claim to merit and originality, is the "*cycle, or period of six figures*," to which the felicitous and dignified name of "*the Sabbatic rest*" is applied. Now, for the life of me, I can only discover in it that which is familiar to every schoolboy in "Practice," namely, that 3*s.* 4*d.* is the sixth aliquot part of a pound sterling; and that, consequently, if it be added together six times it will produce an even pound. Had the completion of this "cycle" occurred at the seventh place instead of the sixth, there might have been some glimmering of common sense in the appellation *sabbatic*, although such a term would have been even then sufficiently droll; but as the case stands, there is neither reason, nor a show of reason, in such misappropriation.

In order to form an opinion as to the application of the table to the every day purposes of ready reckoning, I have acquired (not without a good deal of trouble and puzzling, I confess,) an insight into the manner of using it: the result is, that it requires far more of paper, time, *and even expertness in arithmetic*, to work a question by it, than by the good old school fashion of "Practice," or even by common "Reduction."

There are two examples quoted at page 349, chosen, it must be presumed, as best calculated to show to advantage the power of the table; I shall take the last, as being the longest and most difficult, and therefore most in need of the assistance of a table. I shall set down the work exactly as directed by Mr. Ethelston himself; but I shall also take the liberty of placing "cheek by jowl" with it the same question performed by common arithmetic.

Second Example, 72,845 *at* $9\frac{3}{4}$*d.*

By common arithmetic.

20)72845

3642 5 0

$6d. = \frac{1}{2}$—1821 2 6
$3d. = \frac{1}{2}$— 910 11 3
$\frac{3}{4}d. = \frac{1}{4}$— 227 12 $9\frac{3}{4}$

£2959 6 $6\frac{3}{4}$

By the Table.

72845

6000 = £25
×12 ×12 = 300 0 0

72000
800 = 3 6 8
40 fs. = 10*d.*
×4 = 0 3 4
5 fs. = $1\frac{1}{4}d.$
×4 = 0 0 5

303 10 5
×3
÷4)910 11 3
227 12 $9\frac{3}{4}$

303 10 5
$\times 9\frac{3}{4}$
2731 13 9
227 12 $9\frac{3}{4}$
Answer £2959 6 $6\frac{3}{4}$

Here it will be observed that all the assistance (?) derived from the table is the reduction of 72845 pence to pounds, leaving infinitely the most difficult part of the question to be performed by common arithmetic; *i.e.* the multiplication of a compound sum by 9¾! It must require a romantic imagination, indeed, to call such a complicated jumble of table-searching, addition, multiplication, and division, by the name of "*mental computation*."

NAUTILUS.

March 30, 1840.

CURTIS'S AND ENGLAND'S TRAVERSING SCREW JACKS.

Sir,—I observe in your Magazine of the 28th ult. a letter from Mr. W. J. Curtis in reference to my "patent universal screw jack," which he attacks in a very unfair manner. As he has thought proper to bring the matter before the public, I feel myself bound to make a reply, and confute such attacks, which I will endeavour to do in as explicit a manner as possible.

First, he charges me with "an unwarrantable evasion of his patent traversing screw jack," and he endeavours to make it appear that my invention is a direct piracy of his patent right, or that I must have copied from his arrangements, and merely made some mechanical alterations in order to evade his patent.

The facts of the case as regards my obtaining the patent are simply these:—In my long and intimate connection with railway affairs it had often been apparent to my mind that such a machine was absolutely necessary in order to avoid the loss of much valuable time, which invariably takes place when an engine or carriage happens to get off the line of rails. Early in 1838 I commenced making drawings for a traversing screw jack, and towards the end of that year I submitted them to the inspection of an eminent engineer, whose opinion being favourable, I immediately made an experimental traversing screw jack, equal to about 4 tons, with which I satisfied myself as to its utility by making several trials. On the 23rd January, 1839, I gave instructions to a patent agent to solicit my patent, being about five weeks previous to the enrolment of Mr. Curtis's specification. I therefore could not possibly have had an opportunity of gathering any information from that source, a supposition which Mr. Curtis seems anxious to convey to the public.

With regard to Mr. Curtis's threatened "action to restrain me from making the apparatus," *it is true that* he endeavoured to induce me to treat with him by so threatening an action, and employing an attorney to write to me on the subject. Finding me firm and prepared to defend my invention, his threat "died a natural death," and he has since contented himself with ridiculing the jack every opportunity that occurs. This will not add much to his reputation, for if we have both made a machine calculated to attain the same object, but by different means, and entirely independent of each other, why not let each rest upon its own merits, and not show so much angry feeling as Mr. Curtis has done by attacking me in this manner?

As to his "leaving me to my fate," I should feel extremely obliged to him if he would do so, and not ascribe to my invention the fate that has befallen his own! He states that "upon inquiry at the Great Western Railway he learned that England's jack was found to fail in practice, that whenever it was attempted to traverse the jack with the load upon it, by means of the lying screw, the jack invariably upset, and it was found consequently useless."

Now, Sir, I beg to state that it is next to impossible to upset my patent jack, which fact must be apparent to every mechanical man at first sight; and so far from being found useless on the Great Western Railway, the best reply I can make to that erroneous statement is, the fact that three of my patent jacks have been in use on that line some considerable time, and that on Friday the 27th ult. I received an order from that company for a further supply.

With regard to the statement that Curtis's traversing screw jack had "been proved upon the Croydon, South-Western, and Great Western Railway with complete success," I am not prepared to state what *success* it met with on the South-Western, but I can state clearly and authentically the *success* it met with upon the Great Western Railway. Mr. Curtis sent one of his machines to the Great Western Railway works for trial; such trial took place; the apparatus was decidedly condemned, and he received orders *to take it away again*, which he did. The same machine (the only one he has made) was afterwards sent to the Croydon Railway, where it met the same *fate*.

Mr. Curtis has the temerity to state that my machine "had been offered to the Croydon Railway, but that they refused even to receive it." The Croydon Railway was one of the first lines that I had the honour of supplying with my patent jacks, and there are two in use on that line at the present time.

I do not wish to call your attention to

the defects of Curtis's apparatus, neither should I have said one word on the subject but for the purpose of putting the saddle upon the right horse, and not to allow the *fate* nor the *success* that has befallen Curtis's patent "traversing screw jack" to be saddled upon my patent "universal screw jack."

I fear, Sir, I have already trespassed too much upon your space, and trusting you will do me the justice of inserting this letter in the next number of your journal,*

I remain, Sir,

Your obedient servant,

GEORGE ENGLAND.

Gloucester-terrace, Vauxhall-bridge road, London, April 4, 1840.

THE PRESIDENT STEAM SHIP.

(From the *Liverpool Courier*.)

This vessel the largest ever yet built, arrived here a few days ago under the command of Captain Kean, and is now lying in Sloyne. She is an exceedingly beautiful model; built of the best material that England and England's wealth can supply, and is in every respect a noble vessel. She is now, (her engines not being yet on board,) what is in nautical term, called "light;" and loomes very large. Her proportions are, however, such but for the comparative size of the Queen's mail ships near her, she is so compact that she does not appear at even a short distance to be larger than the "Liverpool." A nearer approach, however, undeceives the beholder, and a visit on board, realizes to its fullest extent the conception of "a wooden world."

She is painted in man-of-war style, with gun ports, and is handsomely rigged as a three-masted schooner, with a foremast, foretopmast, and topgallantmast, approximating to those of a ship. Her bow is fine, and at the extremity of her head-rails will be placed, when completed as a figure-head, a bust of Washington, the hero of American independence. Her stern is projective, beautifully formed to turn off a heavy sea; ornamented aloft with the arms of England and America, quartered in heraldic shield, supported by "the Lion of England," and "Eagle of America." The paddle boxes are comparatively very slightly raised above her bulwarks; and her general appearance is, when her side is viewed, that of a first class frigate of extraordinary size, her light rigging given her at the same time a most rakish and mischievous appearance.

The following are the dimensions :—

	Ft.	In.
Length over all, from traffall to figure-head	273	0
Beam within the paddle-boxes	41	0
Breadth from outside of paddle-boxes	72	4
Depth of hold	30	0
Height between the main and spar deck	8	6
Height between lower and main deck (both flush)	7	8

Tonnage supposed 2500.

Those who are versed in maritime affairs will readily conceive from these dimensions that we are warranted in stating that the President, is in reality, "a wooden world." She is indeed, more—she is a world not only of wood, but of iron, copper, and other materials, constituting the *ne plus ultra* of strength in naval architecture.

The President was built at Limehouse, London, by Messr. Curling and Carter, the latter gentleman superintending her construction throughout. Between decks and in her holds she presents a perfect picture of strength; and we cannot more highly compliment our metropolitan friends and contemporaries in Translantic Steam Navigation, then by stating that they seem in materials, in fastenings, and in putting together, to have taken a leaf out of the book of our townsmen Messrs. Wilson and Co., whose vessels both in point of strength and sailing have hitherto borne the bell.

Every available modern improvement has been taken advantage of in the construction of the President. In addition to a remarkably strong frame, solid to the bilge, she is diagonally fastened fore and aft with iron and wood, in a manner that would seem to defy the rudest assaults of the ocean wave. We have not time to enter into details. Suffice it to say, that the materials of the *President* throughout are of the best quality, and that the utmost science, in a scientific age, has been exerted to work them to the best advantage.

The engines for this vessel will be of about 600 horse power. They are already built by our townsmen Messrs. Fawcett and Co., and present a splendid specimen of the ingenuity and enterprise of the age.

The *President* will present peculiar advantages for passengers. Her spar-deck will afford a long and delightful promenade in fine weather, and during rain or storms a dry and sheltered walk may be enjoyed below.

The cabins are not yet fitted up. The principal or stern saloon will be eighty-seven feet in length; its breadth (including the small state rooms on each side (forty-one feet.

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* Both parties have now been heard. We must therefore warn our correspondents that we can only *admit one communication more from each upon this subject (should they think proper to make it,) and which, we beg, for the sake of our readers, may be as brief as possible.*—ED. M. M.

expense has been spared to render the *lent* a crack ship. In strength of ma- and fidelity of workmanship, she is fully to any of her Majesty's ships of war; fitted up with all the modern improve- in pumps, tanks, &c. She is also d into sections, so that the springing ak (should such take place) would be led with comparatively trifling danger. alculated that the *President* will carry tons of goods beyond her compliment ls, luggage, and materials for a trans- tic voyage. Her steering tackle is of and improved construction; and such equired; for, from her length and size, ay be deemed a floating island.

agents of the *President* at this port, r. Pim, of the St. George's Steam- t Company, and Mr. Macgregor Laird, er of Mr. Laird, of North Birkenhead, lebrated builder of Iron ships.

PATENT LAW ADJUDICATION.

Barsham v. *Taylor*.

l's Court, Chancery-lane, March 27.

. *Pemberton and Mr. Elderton*, for aintiff, William James Barsham, moved injunction to restrain the defendants, s. Taylor and Son, from infringing the of the plaintiff for applying glass or emery to the surface of calico, linen, er woven fabric that had been pulped. application was the invention of Mr. horp, made public by communication to ociety of Arts; a patent had been ed to Richard Edwards, who had as- l it to the plaintiff.

. *Girdlestone and Mr. Rotch, and Mr. ell* opposed the motion, on the ground he invention was not the same as that by the defendants, and expressed their gness to try the validity of the patent .

rd Langdale said, if the matter had before him upon demurrer to the plain- bill, he could have determined it; but was an answer, and no demurrer. The ould remain in court, with a right in aintiff to prove his case, and go on to aring; but he did not think it right to an injunction against the defendants, impose an order upon them for an ac- . The plaintiff's offer to prove his t law must be proceeded in.

Pemberton.—The action at law shall d at the very earliest time it can come on.

rd Langdale.—The defendants must liberty to apply to the Court if there is elay in bringing it on, and until the he present motion must stand over.

NOTES AND NOTICES.

Unwoven Cloth and Glass Tapestry.—Our attention has lately been called to two new inventions—one American, the other, we believe, French—which seem likely to effect revolutions of great though unequal importance in the world of manufacture. The American novelty is a machine by which woollen cloth of every sort is produced at less than a fourth part of the cost hitherto usual. The material is not *woven*, but *compressed*. Two urchins with the machine can turn out 100 yards of the broad cloth in twelve hours; and where 24*s*. were demanded per yard, *six* shillings afford the new manufacturer abundant remuneration. We have inspected and handled (as roughly as we lik ed) specimens of every variety, from the finest scarlet cloth for officers' uniforms, down to blankets and carpets, and we certainly could not, either by sight or touch, distinguish them from corresponding pieces made in the old fashion. The French device is of a very different sort, but must also have very remarkable results. Two specimens of this new manufacture were exhibited at the Marquis of Northampton's last *soiree*, as President of the Royal Society, and they then excited the curiosity and astonishment of the assembled *elite* of our philosophers. They were rich silk curtains, having all the appearance of being inwoven in gold and silver in most gorgeous patterns of arabesque. They looked and felt exactly like the most splendid hangings of the Louis Quatorze taste; but their cost is a mere trifle in comparison, for the *gold* and *silver* are merely *woven glass*. The Queen of the French and her daughters appeared at the last balls in the Tuilleries in dresses manufactured upon this principle.—*John Bull.*

Scientific Necrology.—The world of science has sustained a heavy loss in the death, at Bremen, of the celebrated astronomer Olbers, at the advanced age of 81. He was a member of most of the European learned societies, and the author of many important contributions to the progress of modern astronomy. Letters from Alexandria mention likewise the death of the well-known French engineer, M. Lefevre, travelling correspondent to the Museum of Natural History in Paris. He died at Mahommed-Ali-Polis, in Senaar, in October last, having gone hither commissioned by the Egyptian government to search for the metallic mines supposed to exist in Senaar. While busy with these o ituary records, we may mention the death, at Paris, of Dr. Biett, head physician to the hospital of St. Louis, and a person of great eminence in his profession for all the qualities wich can render its members the benefactors of their kind. His courage and devotions in the fearful times of the cholera will be long remembered; and having by his unwearied humanity and generous sacrifices, worn out his constitution, and laid himself on a death bed at the age of 56, surrounded by the most distinguished of professional brethren, he made his own disease a valuable study for their use, predicting the day and hour of its final struggle, and died amid the most intense sufferings with the calmness of a stoic and the hopes of a martyr.—*Athenæum.*

Hemp.—The hemp of Russia may be superseded ere long by the flax of New Zealand. It is believed, says the *New Zealand Journal*, that the labour of obtaining the latter in its coarse state, and the charges of importation will be fully compensated by a price of 18*l*. per ton here; the expense of dressing will be about 12*l*. more; so that at about 30*l*. per ton, New Zealand flax, in a state to supersede Russian hemp, will be delivered in this country. The price of Russian hemp, in 1839 was 45*l*. per ton; it is now 36*l*., and 40*l*. may be deemed the average.

New Steam Vessel.—Experiments are in the course of being tried with the model of an entirely new form of steam vessel, and, as far as they have yet gone, with every prospect of a successful result. At pres nt we can only state of this remarkable invention, that there are no paddle wheels, nor external works of any kind. The whole machinery is

in the hold of the vessel, where a horizontal wheel is móved by the power of steam, and acting upon a current of water, admitted by the bow, and thrown off at the stern, propels the mass at a rapid rate. By a very simple contrivance of stopcocks, &c., on the apparatus, the steamer can be turned on either course, retarded, stopped, or have her motion reversed. This will be literally a revolution in the art of steam navigation.—*Literary Gazette.*

British Association.—It affords us much pleasure to learn that the arrangements for the meeting at Glasgow, of the "British Association for the Advancement of Science," in September next, are already in a very forward state. The number of admissions for Glasgow, and circuit of fifteen miles round it, has, from the increasing reputation of the Association, been necessarily restricted to 1,400, leaving room for 1,800 strangers (including ladies), this being about an average attendance; and the estimated expense of each meeting, including the cost of museum and models, is about 3,000*l.* The ensuing meeting at Glasgow is expected to be very numerously attended. For the information of noblemen and gentlemen connected with Edinburgh and neighbourhood, who intend to become members, we may intimate that particulars regarding their admission will, in a few weeks, be made public, by the following corresponding committee, appointed for Edinburgh:—Sir John Robison, K.H., Sec. R.S.E.; Sir John Graham Dalyell, Pres. Soc. Arts.; Dr. Graham, Professor of Botany; Dr. Alison, Professor of Physic; Dr. Christison, Professor of Mat. Med.; James D. Forbes, Esq., Professor of Nat. Phil.; Dr. D. B. Reid; Hugo Reid, Esq.; James Tod, Esq., W.S. Sec. Society of Arts.—*Scotsman.*

Ale and Porter Preserved.—In order to save ale and porter in good condition for a considerable length of time it is, for the most part, kept corked down in bottles; and though this method answers exceedingly well, yet it is subject to this inconvenience, that it causes, where a small quantity, as one draught, for instance, is only required, all the rest of the ale or porter in the bottle to go to waste, which must prove both expensive and inconvenient. It is pressure that is the main cause of keeping ale, &c., so well in bottles, and an apparatus is in use by which liquids may be constantly under pressure in casks as well as in corked bottles. The vessel is made in the form of a cask of strong tin, strongly braced by iron hoops, which stands on its end. At the upper end is a cock, soldered to a tube, which is immersed to within an inch of the bottom of the cask. At the same end is a condensing syringe, by means of which air can be forced into the cask; and whenever this is effected it is obvious that the liquor will have a tendency to escape through the tube and out at the cock with a force proportionate to the degree the air is compressed by the action of the syringe. If the cock be then turned the liquor will rush out with violence, foaming, at the same time a great quantity of froth, or what is usually termed a cauliflower head. Every time the air is drawn from the cask, the air it contains is not exposed to the atmosphere, whilst the liquor is kept under pressure, and no vent-peg is necessary. It is said all the advantages of bottling are obtained by the above process, without one-half of the waste and inconvenience attending on the former system.

Gas-making from Dead Horses, &c.—A paper on a gas discovered by M. Jules Seguin, which has been read in the French Academy of Sciences is perfectly free from any hydro-sulphurous element, and also from all carburet of sulphur, and is stated to be admirably adapted for the purpose of giving light. It is made of materials which are not only useless but noxious, as dead horses, old leather, spoiled wool, &c., and is at the same time free from any offensive odour. One old horse will, it is computed, afford on an average 25,000 litres (about 1,525,701 cubic inches) of gas besides sal ammoniac and animal black, and twenty-two litres per hour will keep a single jet burning. The invention seems to be regarded in France with a favourable eye, as leading alike to economy and the removal of a nuisance.

Combustion in Coal Mines.—In 1816, a portion of the coal mines of La Commanterie, in the department of the Allier, took fire, and have been smouldering ever since, occasionally breaking out, but always having been checked without difficulty in the abandoned portion of the mine. A new gallery of more than 400 yards in length, having been recently constructed, some of the earth appears to have fallen in, and thus to have supplied a fresh current of air to the coal in combustion. On the 15th inst., the fire broke forth from all the pits over a surface of 500 yards, and, notwithstanding every exertion to subdue it, was still burning with great force when the last accounts left, at which time an attempt was made to inundate the works by directing to them the waters of a neighbouring brook.—*French paper.*—By a later account, we learn that the fire has considerably abated. It continues to burn, but the flames do not rise above the level of the ground round the excavation. Every part of the pit which is exposed to view is still burning, and thick volumes of smoke issue from several orifices. The works for turning the river Gange into the pit are going on with great activity. The distance is 4,000 metres, and, on the 21st, 3,300 metres of the channel had been cut; and, as 300 men were constantly employed, it was expected that the water would be brought to the point before the 25th.

New Method to Kyanise Timber.—Within the last two or three weeks the Manchester and Birmingham Railway Company have commenced Kyanising their wood sleepers in a much more quick and effectual manner than by the old mode of simply depositing the timber immersed in the prepared liquid. The company have made a large iron cylindrical vessel, weighing about ten tons, and which is about thirty feet long, and six or seven feet diameter, made from wrought iron plates, five-eighths thick, and double rivetted, which vessel is capable of resisting a pressure of 250 lbs. on the inch. This vessel being filled as compactly as possible with wood sleepers, twelve inches broad and seven inches thick, the liquid is then forced in with one of Bramah's hydraulic pumps, and worked by six men to a pressure of 170lbs. on the inch. By this means the timber is completely saturated throughout in about ten hours, which operation, on the old system, took some months to effect.

Wooden Bridge Building.—The *Revue d'Architecture et des Travaux Publics* contains an account of a new system of bridge-building invented by an architect of New York, Mr. Town—as exhibited in a bridge constructed over the James River, at Richmond, in Virginia. This system, stated to be "the most curious of all inventions which the art of carpentry owes to the Americans, who are in the first rank of its professors," entirely differs from all previous practice in bridge-building, is applicable to arches of any span, and peculiarly useful in its adaptation on railroads. Mr. Town uses only planks, so thin as to be readily carried on a man's shoulder. No iron enters into the composition; the planks are united by rivets of wood. These bridges, it is said, will bear any amount or rapidity of traffic, are extremely economic in their construction, and so simple that a village carpenter might superintend their erection In the *Mechanics' Magazine*, No. 861 we gave descriptions of some new American plans of wooden bridge-building invented Col. Long. Ed. M. M.

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Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 871.] SATURDAY, APRIL 18, 1840. [Price 3*d.*

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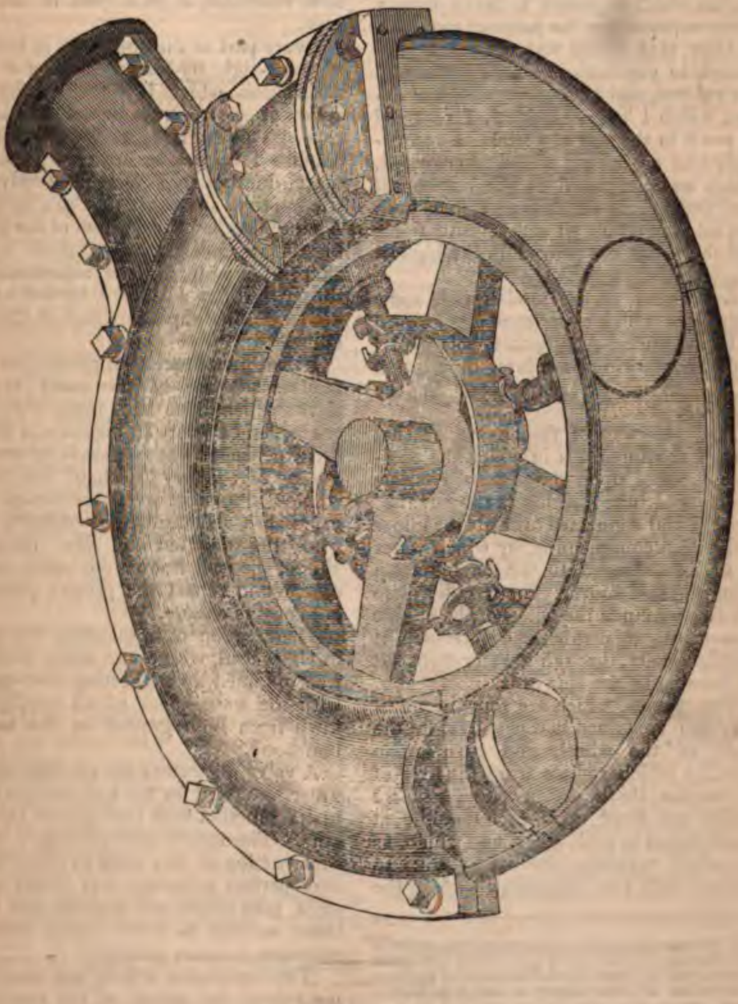
ARMSTRONG'S WATER PRESSURE WHEEL.



ON THE APPLICATION OF A COLUMN OF WATER AS A MOTIVE POWER FOR DRIVING MACHINERY. BY W. G. ARMSTRONG, ESQ.*

Sir,—In an article which appeared in the number of the *Mechanics' Magazine* for the 29th Dec. 1838, I endeavoured to point out some of the great advantages which I conceived would be derived from an efficient method of employing the pressure of a column of water, as a motive power for machinery, and I suggested at the same time, the form of an engine which appeared to me to possess every requisite for the purpose required.

After that article was written I continued to pay considerable attention to the subject, and having matured the design which I had suggested, I resolved to put it to the test of a trial. I accordingly had a working model constructed, which was completed in the autumn of last year, since which time it has been put into operation in several situations, and the result has proved in the highest degree satisfactory.

A drawing of the model, with some alterations which experience has proved to be expedient, accompanies this paper, and the following is a brief description of the engine as represented in the drawing.

The waterway of the engine, or that part of the apparatus in which the pressure operates upon the pistons, consists of a curved tube forming the segment of a circle, and connected towards the upper end with a conduit pipe, by which water is to be conveyed to the engine from some elevated source. The circular plate which surrounds the wheel of the engine passes into this tube, and intersects it longitudinally, through a water-tight slit or opening in one side of it.

The pistons, which are four in number, are contained in apertures in the plate of the wheel, and turn upon spindles which radiate from the axle of the engine. By the action of two *tumblers* which are fixed upon each spindle at right angles to each other, and which, as the wheel revolves, alternately come in contact with two stationary slides, the pistons are caused to open out into the position requisite for the water to act upon, as soon as they have entered the waterway, and again to fold up, on emerging from it, to prepare them for again entering the tube, through the water-tight opening at its opposite end.

The engine is placed in a cast iron frame, which embraces the tube, and resists its tendency to stretch open under the pressure of the water at the slit in which the wheel revolves, but this frame is not shown in the drawing, as it would have concealed a great part of the engine.

Every part of the apparatus is rendered water-tight by leather packing of that description which is tightened by the action of the water in its attempt to escape. This mode of packing hydraulic engines I believe to be more effectual, more durable and less productive of friction than any other that can be used. A more detailed description of the packing is appended to this article in the shape of a note, for the information of those who may wish for a further explanation of this important part of the machine.

I shall now proceed to record the particulars of one of the many experiments which have been made with this engine, and I select an instance in which the experiment was not made by myself, but by Mr. Henry Smith of this town, who is a man of great knowledge and experience in mechanical matters, and who was deputed by Mr. Nicholas Wood, the well known engineer, to ascertain and report the precise performance of the engine.

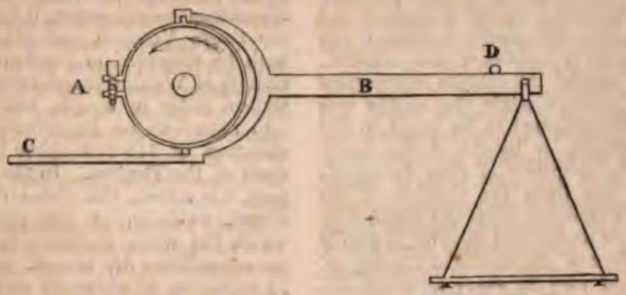
The experiment in question was made in Gateshead, where the water pressure was obtained by connecting the engine with the water-pipes which supply the town from high ground in the neighbourhood.

A valve for testing the pressure of the water was fixed on the supply-pipe close to its junction with the tube of the engine. The utmost care was taken in the construction of this valve in order to insure perfect accuracy, and it was made on a plan which was entirely free from those sources of error which exist in common pressure valves.

The apparatus which was used for measuring the power of the engine is represented by fig. 2. It consists of a

* We beg earnestly to recommend this paper to the attention of our readers; it unfolds with great ability a new and most ingenious means of applying to purposes of great utility, a much neglected, though cheap and almost boundless source of motive power.—ED. M. M.

Fig. 2



friction sheave encircled with an iron band the tightness of which is regulated by a screw situated at the point A. This band is clutched by the forked end of the lever B, at the opposite extremity of which a scale is suspended, and the weight of the lever and scale is balanced by a counterweight hung upon the lever C. A pin is placed at D to prevent the lever from rising above a horizontal position. When the power of the engine is applied to the friction sheave, the weight which is lifted in the scale as far as the free motion of the lever will allow, obviously indicates the retarding force of the friction of the band, and is identical with the weight which the engine would lift on a roller leaving a radius equal to the length of the lever.

After these explanations the following tabular statement showing the result of the experiment will be perfectly intelligible.

Pressure of the water on the valve, 57 lbs. per square inch.

Height of the column represented by this pressure, $131\frac{3}{10}$ feet.

Length of the friction lever upon the end of which the weight is suspended, 4 feet $9\frac{1}{2}$ inches.

Circumference of the circle described by the point from which the weight is suspended, were it allowed to travel round, 30 feet.

Weight lifted upon the end of the lever, 170 lbs.

Number of revolutions of the wheel per minute, 30.

Weight of water discharged per minute, 1,227 lbs.

Theoretic power of the weight of water falling $131\frac{3}{10}$ths feet, expressed in lbs. raised one foot high, per minute, 161,105 lbs.

Effective power of the engine expressed in lbs. raised one foot high per minute, (being 30 feet × 30 revolutions × 170 lbs.),=153,000 lbs.; which is nearly five horses power, according to the usual steam-engine standard, and is within a fraction of 95 per cent. of the theoretic power of the water discharged. As compared with the power which the same quantity of water would produce upon an overshot wheel 18 feet in diameter, the power of this engine under the above circumstances was nearly *ten* times as great.

The extreme diameter of this wheel measures only 2 feet 3 inches. If it had been three times as large, or 6 feet 9 inches in diameter, with the other parts in proportion, its power when acting under the same column would have been equal to no less than that of 129 horses, because the quantity of water delivered at each revolution, and the power produced thereby, are proportionate to the diameter of the wheel multiplied by the square of the diameter of the water-way, so that the power of the model is to that of a similar engine, three times as large in the ratio of 1 to ($3\times3^2=$) 27, and 27 times the power obtained in the above experiment amounts to 129 horses. Hence, theefore, even the most power-

ful engines of this description would be surprisingly small.

In the above experiment the pressure of the water upon the valve was noted while the engine was in action, so that the loss sustained by the friction of the water against the interior surface of the conduit pipe is not taken into account. In other words, the column *represented* by the pressure while the engine was going, was assumed to be equal to the *actual* column or height of the reservoir. The propriety of thus disregarding the loss from the attrition of the column is manifest, since the diminution of pressure occasioned thereby, is wholly independent of the merits of the engine, and would vary in every situation according to the length and capacity of the pipe. In cases where the pipe would not require to be very long it would always be adviseable to make it sufficiently large to render the friction quite unimportant, and then the effective power of the engine would closely approximate to the 95 per cent. of the theoretic power of the column, as well as of the pressure when taken in the manner described.

In the course of the following observations I shall designate engines of this kind *water pressure wheels*, or for the sake of brevity, *pressure wheels*.

The uses to which pressure-wheels may be applied are numerous and important. By their means, the smallest rivulets may be profitably employed if they have only sufficient *fall*, while the power of rapid streams, of more considerable magnitude, may be concentrated at one eligible place, instead of being exerted, piecemeal, in remote and inconvenient situations. It may at first sight be imagined that an excessive length of pipe would always be requisite to acquire the fall, except where the descent of the stream was unusually rapid. This, however, would not be the case, for a stream may generally be conveyed at a high level along one of its banks, in an open cut, until it attains a great elevation above its natural channel, and until a declivity is reached where the fall can be rendered available by a pipe of very moderate length. Even in districts where the rivers are of slow descent, the altitude which diverted streams may often be caused to acquire above the adjacent country is surprisingly great, and wherever this can be accomplished, a most extraordinary power may be brought into operation through the agency of pressure-wheels. By Mr. Telford's Report, in 1834, on the means of supplying the metropolis with water, it appears that the rivers Verulam and Gade, might both be conveyed to London from the vicinity of Watford in one canal of about sixteen miles in length, and delivered into reservoirs on Primrose-hill, at an elevation of 146 feet above high-water mark of the Thames. In the same Report it is stated, that those rivers produced, unitedly, at the points from which the water would be taken, after an exceedingly dry season, upwards of 72 cubic feet of water per second, from which we may infer that the quantity produced under ordinary circumstances would not be less than 100 cubic feet per second.* This quantity flowing incessantly, and suffered to accumulate in the reservoirs at night, would be capable of yielding a power in London, on the margin of the Thames, sufficient to drive 150 pressure-wheels of 20-horse power each during twelve hours of every day, being an aggregate power equal to that of no less than 3,000 horses. The cut or canal called New River, which terminates in the neighbourhood of Islington, at the height of 84 feet above the Thames, is an *existing* instance in the same highly unfavourable district of an aqueduct acquiring a very considerable elevation above the stream which supplies the water. The extreme flatness of the country in this case necessarily renders the cut of very great length, but in other respects it is a work of no engineering difficulty. The volume of water which it carries is about 30 cubic feet per second, but the quantity produced by the river Lea, where the aqueduct commences, and by the springs which are situated in that vicinity, is, I believe, in ordinary seasons, about 100 cubic feet per second. If the whole of this quantity had been turned into the channel of the New River, a power would have been attainable in London, during twelve hours of the day, nearly equal to that of 1,800 horses. In hilly and undulating parts of the kingdom, equally extraordinary effects might frequently be

* See also Parliamentary Report of the Evidence taken before a Committee of the House of Commons in 1834 on the Metropolis Water.

obtained by a cut of comparatively very small extent, for it is no uncommon thing in such parts of the country for rivers, as large as the Lea, to have a fall of 80 or 100 feet within a distance of not more than three or four miles, while the smaller streams, in the same regions, often descend twice as much within the same limits. There are many small brooks, now wholly neglected, which, by operations such as I have described, accompanied by extensive flood water reservoirs, to equalize the supply, would furnish an effective power greater than would be credited by persons who have not duly considered the subject.

But even the water which is already supplied to towns for domestic purposes may, in many cases, by means of pressure wheels, be most advantageously employed for working cranes, lathes, printing presses, and, in short, all kinds of machines to which manual labour is now usually applied as a motive power. The average rate charged by the New River Company for the water which they supply to the metropolis, is 1,000 hogsheads, or 281 tuns, for 17*s.* 2*d.** Now, 281 tuns of water supplied from an elevation of 84 feet (the height of that Company's reservoir), and employed in any of the London wharfs as a motive power for hoisting goods out of ships, would lift (allowing one-third of the theoretic power for loss from various causes) 1,124 tons of goods to a height of 14 feet, which is probably about the average height to which goods are required to be raised in delivering a cargo. Now to perform the same quantity of work by manual labour would cost, calculating at the very moderate rate of 2½*d.* per ton 11*l.* 14*s.*, instead of only 17*s.* 2*d.* when done by the water. Nor would the cheapness of the power be its only recommendation, for the expedition with which the work would be executed would be another most important advantage. In the present instance a pressure wheel only 27 inches in diameter, which is the size of my model, would lift a given weight as rapidly as it could be raised by the united labour of at least 12 men.

Pressure wheels supply all that is wanted for effectuating the important principle of transmitting and distributing the power of a steam engine by means of hydraulic agency. When water is lifted by a pumping engine it becomes the recipient of the power exerted in raising it, and if the same water be used as a motive power during its descent to its original level, it renders back the power conferred upon it by the engine, and thus becomes the medium through which the power of the pumping engine may be transmitted to a distance, and distributed in large or small quantities as occasion may require. The application of this principle, and its immense advantages, may be illustrated as follows:—Suppose a steam engine of only ten-horse power to be incessantly employed in the vicinity of the London and Saint Katharine Docks, in pumping water from the Thames into a large cistern placed on the top of a warehouse built 80 feet high for the purpose; and suppose the water thus raised by the steam engine to be conveyed in pipes from the cistern to all parts of the docks and the adjacent wharfs, and applied to pressure wheels, as a motive power for hoisting goods, as well out of ships as into the warehouses. Now the quantity of water which the steam engine would lift into the cistern in the course of every twenty-fours would be, in round numbers, 2,500 tuns, and the theoretic power of that quantity of water descending 80 feet would be equal to 10,000 tons lifted 20 feet high. Assuming the pipes to be made sufficiently large to prevent material loss by the attrition of the water, we have only to deduct from this power five per cent. for the friction of the pressure wheels, and say twenty per cent. for that of the cranes, and there remains a practical effect of 7,500 tons lifted 20 feet high. This result I believe to be more than equivalent to all the cranage and hoisting which is daily performed in these docks, and the whole commercial district which surrounds them, and thus would the indirect agency of one small steam engine supersede the labour of hundreds of men, and effect thereby an annual saving of many thousand pounds.

But, it is not only in cases where power is required in small quantities, that the indirect agency of a steam-engine can be profitably employed. Wherever the presence of a steam-engine is objectionable, its transmitted power may be advantage-

* *See Parliamentary Report on the Metropolis water, 1834.*

ously resorted to, and wherever the work to be performed requires an *intermittent* exertion of power, the *indirect* agency of an engine would be cheaper than its *direct* application, as will more clearly appear in the sequel. Both these cases are involved in the application which I shall next proceed to propose, of transmitted power for the purpose of underground haulage in mines.

The great expense of using horses in mines, has led to the partial substitution of underground steam-engines, but the smoke and heat which they produce, the great space which they occupy, and, in the case of coal mines, the danger of fire and explosion which they occasion, must ever preclude their extensive adoption. Now all these objections would be avoided by using pressure wheels in a mine, and employing additional pumping power at the surface, to raise water for propelling them, or, what amounts to the same thing, to bring back the water they discharged. The benefit of engine power would then be obtained in the mine, without fires, and with an apparatus of extreme smallness, which would be easily removed from place to place as occasion required.*

I have just observed that whenever an *intermitted* exertion of power is required, the indirect agency of steam would be cheaper than its direct application. The reason of this will now appear. Haulage power in a mine is only required *at intervals*, and since pressure wheels employed for the purpose, would only discharge water while they were in actual operation, *one* steam engine at the surface, by going *continually*, would be enabled to raise as much water as *several* pressure wheels, each equal in power to the steam engine, would discharge in the mine during the periods of their actual operation. Now if underground steam-engines, were used, we should then have *several* engines going *occasionally*, instead of *one* engine going *incessantly*, and since power would be produced by the incessant operation of one engine, at a far cheaper rate than by the occasional operation of several, it follows that the indirect agency of steam, would in this case be more economical than its direct employment.

Pressure wheels would be equally applicable in all parts of a mine, whether above or below the level of the pump-well. If above, the water would naturally find its way to its proper destination, and if below, it would only be necessary to envelope the wheel in a water-tight case, and attach a return pipe, in which the exhausted water would rise as it accumulated in the case —the back pressure in the return pipe merely neutralizing that part of the impelling column which extended below the pump-well.

There is yet another method of obtaining water pressure which deserves particular notice. By collecting drainage water in spacious reservoirs on high table lands, and conveying the water in pipes into the plain or valley below, an abundance of power might be obtained in many situations where it would be of the utmost value. The celebrated Shaw's water, near Greenock, strongly exemplifies the efficacy of this method. In that instance the drainage of only 5000 acres of very elevated land affords a constant supply of water, which is computed to be capable of producing in its descent a power exceeding that of 2000 horses.

Attempts have lately been made to revive the principle of Dr. Barker's mill, which was propelled by the *re-action* of a column of water; but I conceive that none of the many theories which have been given of *re-acting* engines, afford a prospect of deriving from any machine of that nature an efficiency equal to that possessed by my engine. The recent French invention, called the turbine, is an admirable application of this principle, and is said to produce an effective power of from 75 to 80 per cent. of the theoretic power of the water discharged. Mr. James Whitelaw, of Glasgow, has also lately produced a re-acting water-engine, which is said to possess great efficiency; but I am not aware that the particulars of any experiments have been made public by which the accuracy of the newspaper accounts can be judged of. I believe engines of this kind to be capable of very useful application, but the excessive speed at which it is necessary to work them, especially when the pressure is great, is a serious objection to them, and one which would render them highly unsuitable for many of the pur-

* *A pressure wheel only 3 feet in diameter situated at a depth of 50 fathoms, would be nearly equal to a 20 horse steam engine.*

poses I have mentioned. The turbine, in the Black Forest in Germany, is stated to make 2,000 revolutions per minute, the reduction of which amazing velocity to a degree of speed such as the generality of purposes require, cannot be effected without cumbrous machinery, and great loss of power by friction.

I do not pretend, however, to say, that the particular *form* of engine which I have adopted, is the only one by which all the various and important applications of water pressure which I have enumerated, can be fully effectuated. At the same time, I certainly consider that the principles of that engine cannot be departed from without diminishing the power obtained, and encountering other disadvantages. In order to produce the greatest available effect, there can be no doubt that the water must act by its *direct pressure,* and not by its *re-action.* I consider it indispensable that the motion of the impelling column, should be perfectly continuous and uniform, which involves the necessity of a *rotary* action, ut excludes all that description of rotation engines, in which the ingress of the motive fluid is cut off at some point in each revolution. It is likewise of importance that the water should not be caused to acquire any increased velocity by passing through contracted induction and eduction passages.

The density of water being so very much greater than that of steam, its tendency to escape is comparatively very small, which circumstance relieves rotary water engines from those difficulties which appear to be almost insuperable in steam-engines of the same class.

In conclusion, I have only to observe that the application of water power appears to me to have long been a much neglected subject. While the steam-engine has been advancing to its present state of perfection, not a single improvement has been made upon the cumbrous overshot wheel, which is still the only method in common use for employing a fall of water. A power so energetic and yet so safe, so cheap and so free from nuisance, as falling water, is greatly to be preferred wherever it can be obtained to the agency of steam. Every method, therefore, of rendering the power of water more extensively available must be of the utmost value, and if my present attempt to forward so desirable an object should fortunately prove successful, I shall feel myself amply rewarded.

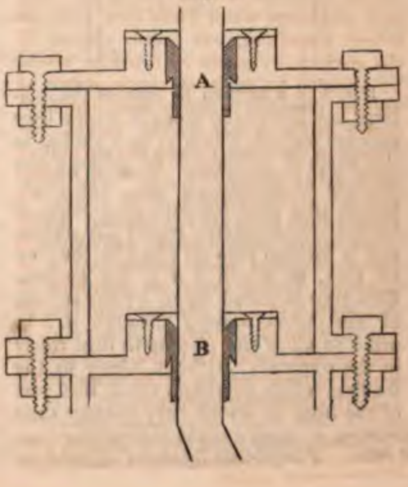
W. G. ARMSTRONG.

Jesmond, near Newcastle-upon-Tyne,
31st March, 1840.

Note.—Fig. 3 is a section of the tube with the plate of the wheel intersecting it, and shows the method of packing employed to prevent escape at the opening through which the plate enters the tube. The shaded parts represent the leathers, each of which projects into a

Fig. 3

Fig. 4



groove in the thick part of the plate, and is placed between two brass segments which form a slight metallic packing, independently of the leather. The whole packing is pressed downwards by screws which are placed in the frame-work of the apparatus, and which act in the direction of the lines *a a*. It will be readily perceived that the water, in endeavouring to force a passage, will press the projecting lips of leather against the upper sides of the grooves, by which it effectually cuts off its own escape.

Fig. 4 shows the method of preventing escape at the opening in the upper end of the tube. Two sets of packings are here made use of, one at A, and the other at B, and the interval between them is equal to the diameter of the pistons. Each packing consists of a flap of leather which is pressed against the sides of the plate by the action of the water. The object of having two packings is to prevent the escape which would otherwise take place on the entrance of the pistons, in consequence of the apertures in the plate which hold them being considerably larger than the pistons themselves.

Fig. 5

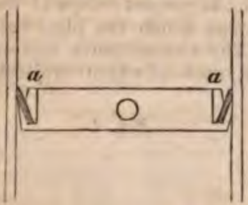


Fig. 5 is a section of one of the pistons, and shows the mode in which they also are packed, which is very similar to the method employed in packing the buckets of mining pumps. The packing in this case consists of a strap of leather which passes round the piston, and is wedged into its place by the metal ring, of which *a a* is the section. This ring is bolted down by the spindle of the piston passing through it. In order to allow the pistons to turn freely in the water-way without injury to the leathers which surround them, that part of the tube in which they change their position, is made considerably wider than the rest. The piston leathers should be made without any seam, which may easily be effected by a process similar to that of cupping leather.

MR. RENNIE'S TRAPEZIUM PADDLE WHEELS.

In the course of last week the *Lily*, belonging to the "London and Westminster Company," made several experimental trips fitted with the trapezium paddles, recently invented and patented by Geo. Rennie, Esq. The results of all these trials have, we understand, been eminently satisfactory. In one which we had an opportunity of witnessing the distance between London Bridge and Woolwich was made in 51 minutes. The tide was running down but there was rather a fresh head-wind against us. The same distance back was made in one hour and twenty-three minutes. It should be remarked, that in both instances there were frequent delays caused by the crowded state of the Pool and the river below. However, the rate of absolute steaming, or the equivalent of her speed in still water, as shown by an average of several trials with Massey's log during the down and up passage, was very nearly seven miles per hour. We were informed that this was an increase of about one-seventh upon the average of several previous trials with the old rectangular floats. The engine made throughout from 35 to 36 strokes per minute. The diameter of the present wheels scarcely, if at all, exceeds that of the old ones, and the distance of the centre of pressure from the axis is nearly the same in both.

The very curious fact established by these trials of a positive increase of speed being obtained with little more than ⅔rds of propelling surface would seem to indicate some mechanical superiority peculiar to the trapezoidal figure compared with the rectangular as an instrument of propulsion. Other advantages attending this form are great smoothness of motion, little agitation of the water, and an *absence* of all that tremulous vibration so generally complained of by steam-boat travellers—effects due, no doubt, to the greater ease with which floats of this form enter into and emerge from the water. Nor ought it to be overlooked that the trapezoidal

form admits of much greater compactness, simplicity and lightness in the working portions of the wheel than the rectangular. We are happy to learn that there is a probability of an early application of the principle upon a much more extended scale. (From a Correspondent.)

April 12, 1840.

FORMULA FOR MAKING ENVELOPES.

Sir,—I herewith forward for insertion in your Journal, should you deem it worthy a place, an expeditious and cheap method of forming a *neat* and *servicable* envelope, by a simple and ready rule applicable to *all* sizes, and by correct geometrical rule for developable surfaces.

A D Given
A C $=\frac{5}{8}$ of A D
B E $=$ A C
F H $=\frac{5}{8}$ of A C.

The other parts being facsimiles are not given; the pattern is cut out of a piece of thin metal or pasteboard, and being laid upon a quire or two of paper, the whole is cut through at once.

I give the preference to the above design for the following reasons:

1st, Having the fewest possible number of edges, or sides.

2nd, All those edges being straight lines.

3rd, All the proportions being derived from one dimension, the length of the letter to be enveloped.

I remain, yours respectfully,
Wm. Jones.

Manchester, March 26, 1840.

HALL'S HYDRAULIC BELT.

Sir,—"Nautilus" in your Journal, No. 870, appears to have fallen into a slight misapprehension with reference to the purport of my communication, although I must admit the omission on my part, of the reasons which induced me to take the second experiment as the basis of my calculations gave some ground for the suspicion of a covert motive in my strictures. I ought to have explained, that the notes of the first trial were taken entirely by myself, and it was in consequence of a gentleman present, who I believe represented the patentees, expressing a wish that any conclusion to be drawn from the working of the belt, might rather be the result of another experiment, when the pressure of the steam in the boiler should become raised to the average working height—that the second trial was undertaken, the details of which were checked by both of us in conjunction. My object will therefore at once be understood in taking the latter result for the ground of my subsequent deductions as being in accordance with the wish of the parties most interested, and under what they conceived to be the most favorable condition of the machine, and not as "Nautilus" intimates from any disingenuous or ulterior purpose.

"Nautilus" has fallen into a trifling error in his calculations of the amount

of effective power, evidently from a misconception of what constituted the *stroke* of the engine; which, among engineers is generally understood to comprise one entire revolution of the crank shaft. To have been sufficiently explicit, I ought, perhaps, to have said fifty *double* strokes per minute was the working speed of the engine. Nevertheless, by a strange coincidence, the calculation as it stands is pretty nearly what the effective power would be for 25lbs. and 30lbs. pressure per square inch (which were the conditions) calculated by Tredgold's Formula, and therefore, by an accident "Nautilus" comparison so far holds good.

I ought to observe, that the more favorable ratio of the duty to the power in the first experiment did not escape my notice, in evidence of which I beg to refer to my communication in No. 867, though for the reasons given above I omitted at the time calculating the precise proportion.

With respect to the present patent I do not conceive that it can claim the merit of much originality. I have a lively impression of having read or heard of a similar contrivance working in one of the Cornish mines, in which the belt was of horse hair; with respect to the rope pump alluded to by "Nautilus," I should be much disposed to doubt the estimate quoted of its work. For, the actual weight of water raised by one man, exclusive of the power necessarily absorbed by the friction, considerably exceeds the average of human strength as given by any experimentalists under the most favourable circumstances, and would throw into the shade even the wonder working pump of Mr. Shalders, whose rather startling announcement it must be confessed, has very much a tendency to shake our faith in the generally received mechanical axiom of the *non generation* of power. But the discrepancy it is probable rests with "Nautilus" in having deduced a general expression for the power *of the man*, from what was merely intended to denote the efficiency *of the machine*, for we cannot suppose an effect so extravagant to be the result of any continuous exertion of human force.

In conclusion, I trust I may be allowed *to state that I* have not the slightest in*terest in the* success of the patent or otherwise; neither was I aware of its history until enlightened by "Nautilus." My object in publishing the experiments was simply to call attention to its merits as an efficient hydraulic machine, particularly at high lifts. For I do not conceive that it will ever compete with the common pump at short depths. As regards any intentional simulation or apparent collusion with any parties interested, I trust that I shall be sufficiently exonerated therefrom by the terms of this *amende*.

Yours, &c.

INDICUS.

April 13, 1840.

THE LONDON GAS COMPANY AND REV. MR. BACON.

Sir,—I perceive that after the lapse of two weeks no answer has been returned by the Chairman and Directors of the London Gas Company to the statements of my last communication. Considering how deeply those statements affect the honor and the interests of themselves and of the Company they represent—considering also the undeniable right which I personally possess to an answer to those statements, I feel that it is no longer premature to express my surprise at the silence which these gentlemen have thought proper to maintain. To recur to the concluding topic of my last letter; viz. the representation made by the Directors in their answer in Chancery, and by their manufacturers in a distinct answer on oath, that *the sales of Mr. Hutchison's burner have been confined to the London Gas Company and their customers:* This assertion, though thus sanctioned by the authority of the defendants in two distinct suits; and though it has been twice deliberately repeated within the last few months by the solicitor for those defendants, in two written statements prepared by him for the purpose of depriving me (on the grounds previously explained) of the services of the Solicitor-General, *I have discovered not to be founded on truth*, and that the contrary is well known to inspectors and others employed by this Company.

In my last letter I ventured to express an opinion that the Chairman and Directors of this Company and their solicitors, must have been kept in ignor-

ance of these sales; and that it would be in their power to disclaim all knowledge on the subject. From the information which I possess, and from their own silence on the subject, I feel that I am no longer at liberty to entertain that opinion. I must now therefore require from the Chairman, the Directors, and the Solicitors of the London Gas Company their own explanation of this transaction. That explanation can no longer be delayed or evaded. To their own vindication it is essential—it is equally indispensable to mine—indispensable in order to enable me to justify in the fullest manner the statements which I have already submitted to the public with regard to the character of these proceedings, and the spirit which actuates the parties with whom they originated. It is also indispensable to protect me against the discreditable attempt, still persevered in and based on this misrepresentation, to deprive me of the advocacy and advice of the distinguished individual to whom I have entrusted the defence of my rights.

Let me add, that I am entitled on the present occasion to ask, not only for an explanation, but also to require *some reason* why that explanation has been withheld up to the present time? It may possibly be, Sir, that to these my humble views of justice the individuals referred to will pay but slight regard. But while I suspend my judgment on their conduct, I may without impropriety observe that I cannot enter into their feelings, and that under the same circumstances I should not have pursued the same course. Had I discovered that any agent of mine had by means of misrepresentation obtained at the expense of any member of this Company advantages for me which I ought not to possess—if I knew that my agent or my solicitor was attempting at this very moment to obtain by the same means fresh advantages equally unjust, it would not, I affirm, be consistent with my feelings to remain passive under such circumstances. Moreover, if those advantages were obtained or sought not in the ordinary business of life, but in the administration of justice, I should find a still more powerful motive for instant interposition. These it is true, are merely my own personal feelings on such subjects, but I think I cannot be wrong in saying that they are the feelings which should actuate every upright and honorable mind.

I am, &c.

HUGH FORD BACON.

Fen Drayton, April 13, 1840.

12, New Inn, April 14, 1840.

Sir,—By Mr. Bacon's directions, I send you a brief narrative of certain facts, to which, as I am informed, he intends to advert:—

Having retained the Solicitor General for Mr. Bacon in an action brought by him against Messrs. Jones and Talby, the manufacturers of Mr. Hutchison's burner, I found that Messrs. Foss and Clark, their Solicitors, claimed for them the benefit of a *general Retainer*, given by the London Gas Company, on the ground that their sales had been strictly confined to the Company and their customers. To this fact Messrs. Foss and Clark pledged themselves in a written statement, which, from evidence in my possession, I felt it necessary distinctly to contradict. Messrs. Foss and Clark having repeated their representation in a second written statement, couched in even stronger language than the first, I thought it advisable to test, by personal observation, the authority of the evidence I had obtained. I had been informed (among other instances) that Mr. Hutchison's burner had been sold at Bromley in Kent, which I regarded as an extremely aggravated breach of faith—Mr. Hutchison, the patentee and Company's engineer, being the proprietor of the gas works in that place. On visiting the town, I found these burners in general use in the shops, and hotels.

Subsequently I called on Mr. Hutchison himself at his house in Vauxhall, and required him to admit these sales in writing, to enable me to set the question of retainer at rest. *He did not deny the sales at Bromley*, but would not say more than that he should have to see Mr. Foss, by appointment, in the course of the day. Upon hearing which, I wrote to Messrs. Foss and Clark, informing them of my interview with Mr. Hutchison, and requesting them to take that opportunity of judging for themselves as to the fact of the sales, and to withdraw their statement accordingly, adding that I was ready to meet Mr.

Hutchison at their office. *To this communication they have returned no answer.*

I feel it right to observe, that it is not in my power under all the circumstances of this case, to confirm an opinion which I find to have been expressed by Mr. Bacon, in your Magazine for the 28th of March last, that these sales were carried on by Mr. Hutchison without the knowledge of the chairman and directors of the company or their solicitors. The circumstances of the chairman and directors not having thrown the onus of this misrepresentation on Mr. Hutchison personally, and not having retracted the misrepresentation itself, but, on the contrary, having suffered it to be used on their behalf, for the purpose of depriving my client of the advocacy of the Solicitor General, are, Sir, I must own, calculated to raise a contrary presumption in my mind. It is not, however, my wish to express any opinion, but merely to state the facts as required from me by Mr. Bacon, in support of which I consider his most justifiable demand of explanation from all these individuals.

I am, Sir,

Your obedient servant,

R. H. Baines.

MR. SMEE'S NEW CHEMICO-MECHANICAL GALVANIC BATTERY.

The *London and Edinburgh Philosophical Magazine* for this month contains a remarkably interesting paper by Alfred Smee, Esq., on the "Galvanic properties of the principal elementary bodies," with a description of a new battery invented by Mr. Smee, and called by him the "Chemico-Mechanical," which for all those *working* purposes on which the minds of men are now so intent, seems greatly to surpass every preceding invention of the kind. The superior efficiency of this battery depends chiefly on two properties of metallic bodies first brought to light by the experimental investigations of Mr. Smee (more fully at all events than they ever were before), namely, 1. That the galvanic energy of metallic surfaces is in proportion to the number of points on such surfaces; and, 2, That platinum, which has long ranked at the head of the galvanic metals, may be precipitated in powder on the surfaces of other and cheaper metals, so as to make them equal *for galvanic purposes* to platinum itself in *its most comminuted* state, such as *spongy platinum,* which consists of almost an infinity of points. The battery is thus described by Mr. Smee:—

"The battery which I now propose is to be made of either copper plated with silver, silver, palladium, or platinum. The silver can be rolled to any thinness, and therefore is not expensive. Each piece of metal is to be placed in water, to which a little dilute sulphuric acid and nitro-muriate of platinum is to be added. A simple current is then to be formed by zinc placed in a porous tube with dilute acid; when, after the lapse of a short time, the metal will be coated with a fine black powder of metallic platinum. The trouble of this operation is most trifling; only requiring a little time after the arrangement of the apparatus, which takes even less than the description. The cost I find to be about 6*d*. a plate of 4 inches each way, or 32 square inches of surface. This finely-divided platinum does not adhere firmly to very smooth metals, but when they are rough is very lasting, and sticks so closely that it cannot be rubbed off. On this account, when either silver is employed, or copper coated with silver, the surface is to be made rough by brushing it over with a little strong nitric acid, which gives it instantly a frosted appearance, and this, after being washed, is ready for the platinizing process.

"With regard to the arrangement of the metal thus prepared great diversity exists; it may be arranged in the same way as an ordinary Wollaston's battery with advantage; a battery thus constructed possessing greater power than Professor Daniell's battery: four cells, containing 48 square inches in each cell, decomposed 7 cubic inches of mixed gas per five minutes, whilst four cells of Professor Daniell's, in which 65 square inches of copper were exposed in each cell, gave off only five cubic inches in the same time. However, in my battery thus arranged, the action dropped to five cubic inches in five minutes, but it resumed its power after the contact had been broken for a few seconds. This battery also possesses great heating powers, raising the temperature of a platinum or steel wire, one foot long and of a thickness similar to that used for ordinary birdcages, to a heat that could not be borne by the finger.* Its magnetic power is not less astonishing, three cells supporting the keeper of a magnet through

* A small pot battery of six cells fairly fused into globules two inches of iron wire, and the combustion of different metals was extremely brilliant, when the battery was in combination with a Bachoffner's apparatus. A small piece of silver platinized (two inches each way) with a fold of zinc, was connected with a large temporary horseshoe magnet, when it supported upwards of three hundred weight.

forty-five, two cells through thirty-two, and one cell through twenty thicknesses of paper. An electro-magnetic engine was made to rotate with great velocity, the combustion of the mercury at the breaking of contact being exceedingly brilliant.

"A battery of this construction should be in every laboratory, to be used in most cases where a battery is wanted, and the slight labour attending its operation is scarcely worth mentioning. I have used one for 48 hours consecutively without the slightest alteration either of the fluid, or in the arrangement of the metals, and the diminution attending its operation appeared to arise from deficiency of acid, for it *was instantly restored* by a little strong sulphuric acid in each cell. Where the battery is required to possess the same power for a long period, it might be advisable to separate the metals by a porous earthenware vessel, or what answers the purpose equally well, by a thick paper bag, the joinings of which must be effected by shell-lac dissolved in alcohol. By these means the sulphate of zinc is retained on the zinc side of the battery. The use of porous tubes, however, appears from observation, as far as my battery is concerned, *to be nearly superfluous*, at any rate in most cases; for I find that after a battery arranged as Wollaston's had been at work in the same fluid *for forty-eight hours*, it had no zinc deposited on the silver. It is worth remarking, that during the last 24 hours contact had not been broken for a single instant. Notwithstanding these experiments, however, it may be as well in an extensive battery to use porous plates.

"The battery may be arranged like the pot batteries, but I should greatly prefer the troughs, such as used for Wollaston's batteries, from the convenience of packing, and from a battery of the same surface requiring so small a space. A battery may be constructed to form a most powerful calorimotor. It may also be arranged as a circular disc battery. Or it may be made as a Cruickshanks, each cell being divided or not by a flat porous diaphragm. Whatever arrangement is adopted, the closer the zinc is brought to the platinized metal, the greater will be the power.

"The generating fluid which is to be employed is water, with one-eighth of sulphuric acid by measure; and the zinc ought always to be amalgamated in the first instance, as that process will be found very economical from its stopping all local action, and the amalgamation will be found not to require repeating, because there is no fear of copper being thrown down on the zinc, which occasionally happens in the sulphate of copper batteries.

"*The battery thus constructed is the cheapest and least troublesome in action that has ever been proposed*, and from the smallness of its bulk will be found very valuable to electro-magneticians."

Mr. Smee adds:—

"This battery may remain in the acid for any length of time, and neither the amalgamated zinc nor platinized silver will undergo the slightest change, and the whole will be as silent as death. Let only communication be made, the liquid in each cell becomes troubled; it boils—it bubbles, and produces the effects which have been detailed."

VISIT TO MESSRS. FAWCETT AND CO.'S ENGINE FACTORY, LIVERPOOL.

(From the *Liverpool Standard*.)

The object of the establishment is principally the construction of marine and other steam engines, mill machinery, pieces of ordnance, and other heavy articles of the foundry and the forge, which here pass from their rudest state, through the various requisite processes, until they are turned out bright and perfect from the hands of the finishers. The magnitude of the works may be estimated from the facts, that the premises stand upon an area of many hundred yards; that that space, nearly covered by lofty buildings, is found incommodiously small; and that the number of workmen employed in the various departments considerably exceeds seven hundred. The writer of this was a few days ago politely permitted to view the works, and was furnished with such information as the shortness of his visit would allow, by one of the partners, as well as by an attendant. We shall now notice the several departments under their respective heads, and shall conclude with some particulars of the fine marine engines now in a state of forwardness.

Founding and Boring of Cannon.

On entering the yard the attention of the visitor is arrested by the great number of cannons of various sizes and calibres, from swivels and half-pounders to thirty-two pounders, ranged on the ground, or peeping, in carriages, with portentous aspect, from door-ways, entrances, and corners. The large guns are of various fashions, some being cast from the plain models used in the French navy, others from those of the Dutch, and others (the handsomest to our thinking) of the more decorative form approved in England. In casting these guns (all solid), what is called "a head" is cast along with them, at the muzzle end, having the appearance of a plug or long tompion. This, which is cut off before the boring is commenced, is for the purpose of resting the piece at that end, while it is exteriorly cleaned off and polished. At the breech, too, an additional square piece of the metal is cast on, by

which the gun is turned by machinery while it is being bored, the borer being stationary in the operation. When outwardly cleaned and finished (with the exception of drilling the touch-hole and fixing the lock), the gun is placed horizontally, and secured so as to turn without vibratory motion. The machinery is then applied, and the gun turns rather slowly, advancing with an even pressure upon the large steel boring instrument, and continually discharging the metal which it cuts out. The gun has to be bored two or three times, according to its calibre, and when the operation is completed the bore is as bright and true as that of a fowling piece. The touch-hole is afterwards drilled out with great nicety, as are the holes, in raised portions of the breech, for the fixing of the flint lock, which has now in gunnery almost superceded the use of the match. Several guns are bored daily and simultaneously, to meet the demand at home and abroad, and a large "assortment" is kept constantly on hand to supply those governments and individuals who are bent on "mischief" or self-defence. Amongst the pieces of ordnance now in preparation or finished at the works are:—

26 thirty-two pounders, for a French house.

20 twenty-four pounders, another French order.

4 twelve pounders, for the same.

The Foundry.

This part of the works differs from most other foundries only in the immense weight of the castings, which, from the size of the building and the number of blast furnaces, cranes, &c., may be turned out. Single pieces of twenty tons each might be accomplished, if required. The operation is interesting, but it is too generally known to require detail. The article to be cast is moulded (in sand) from wood, and enclosed within iron frame-work, a hole being left for the entrance of the metal. The metal (cast iron) is thrown, in broken pieces, mixed with coals, into a large cylindrical furnace, the blast thrown into which, by machinery, with great force, makes a roaring noise, and soon brings the whole to a white heat. The metal, as it melts, sinks to the bottom. When all this is ready, a perforation is made with the point of an iron rod, through a sort of doorway at the bottom, which at that point is stopped up by fire clay. The boiling metal immediately rushes out in liquid white fire, and is received in pots with three long horizontal iron handles, two at one side, like those of a hand-barrow, and one at the other. By these it is carried by three or four men, according to its weight; and if the casting or castings be comparatively small, the metal is poured at once from this into the moulds, the pot being turned by the men holding the two handles. If, however, the casting be large, the smaller pots full of liquid metal are discharged into a cauldron of sufficient size, and this, from its great weight, is hoisted by a crane and placed over the casting, where it is discharged, in a careful manner, of its contents. The air, forced out of the sand by the metal, frequently makes a loud explosion, (as we witnessed on Monday,) and when the intense heat of the hissing iron perforates the outer portions of the same, blue and sulphureous looking flame issues from the sides in all directions. When the metal is sufficiently cooled, the frame-work is removed, and the castings taken out. Here may be cast any article, from a lath nail to a steam-engine cylinder, weighing from ten to fifteen tons.

The Working-Engine on the Works.

On the east of the yard, on each side of which are the extensive buildings, is the larger engine, of thirty-six horse power, which works the greater part of the machinery used in the different rooms, in the several operations of turning, plaining, drilling and otherwise "torturing" the obdurate but conquerable metal that falls under the cruel hands of the workmen. This engine is of the old-fashioned principle, with an immense wooden beam, secured with iron, and a large fly-wheel. It is, however, most effective, communicated by cog-wheels and shafts with the several rooms in which the power is appled to the lathes, &c. by drums and shafts. There are also other engines, but of considerably less power.

The Smithy.

This is one of the most extensive portions of the establishment. It comprises two large buildings thrown into one; and a great number of workmen are constantly employed. There is an avenue of anvils, and the constant hammering, the blowing of their fires, together with the dusky visages of the athletic workmen, remind one of the description of the abode of the Cyclops. Here, however, "bolts" are "forged," of which neither "Jove" nor his armourer "Vulcan" could have conceived any notion. All the iron-work for the steam engines is here made, with the exception of the very heavy paddle-shafts, which are brought in the rough from the Mersey Forge.

The Planing-machine Room.

In this room are valuable and elaborately-contrived machines for the planing or levelling of large plates, or other pieces of iron or brass, so as to give them a smooth, true, and polished surface. The article or piece to be planed is securely fixed by screw-bolts, &c., to an horizontal iron table, perforated with holes for the insertion of the bolts from beneath it in any required point, to suit the size or form of the article. This table, when put in motion, travels backwards and for-

wards with its load on two iron rails, or parallel slides. Over the centre is perpendicularly fixed what is called the "planing tool," an instrument made of steel, somewhat in the form of a hook, with the point so inclined as to present itself towards the surface of the metal to be planed, as it approaches it on the table, so as, when all is adjusted, to plough or plane it in narrow streaks or shavings as it passes under it. The extremity of the tool is about half an inch to three-quarters in breadth, and being of a round form at the under side, and ground or bevelled on the upper, presents a sort of point. If a plate of iron is to be planed, the operation commences on the outer edge, and each movement backwards and forwards of the table places it in such a position under the tool, that another small parallel cut is made throughout its whole length. The tool, in ordinary machines of this kind, is fixed so that it cuts only in one direction, as the plate is drawn against its edge or point, which is raised to allow of the backward motion of the plate. A new patent has, however, been obtained for a great improvement in this respect by Mr. Whitworth of Manchester, and several of his machines are on Messrs. Fawcett and Co.'s premises. In these, by a peculiarly beautiful contrivance, the cutting instrument, the moment the plate passes under it, "jumps" up a little in the box or case to which it is attached, and instantly "turns about" in the opposite direction, and commences cutting away, so that both backwards and forwards the operation goes on without loss of time. The workmen very quaintly and appropriately call this new planing tool "Jim Crow." A workman attends to each of the machines, and when the piece to be cut is fixed with great exactness on the moving table, by a spirit level, he has nothing to do but to watch that it remain so, and that the machinery work evenly and correctly. Where a very smooth surface is required, the operation of planing is repeated, and two plates thus finished will be so truly level, that they will adhere together. It should be added, that so perfect are these machines, that in addition to planing horizontally, they may be so adjusted as to plane perpendicularly, or at any given angle.

The Turning Rooms.

In several of the rooms both beaten and cast iron of all possible dimensions are turned, with astonishing facility and correctness, on what are called slide lathes. In one of these we saw the paddle-shafts for the President under the operation. Each of these weighed, when they came from the forge, about ten tons, and they will be but slightly reduced in weight by turning. In the same room large piston and other rods were being turned. While the shaft or rod is revolved, the cutting instrument, fixed to a slide, on which it is slowly and evenly carried along, performs its operations with wonderful precision, frequently cutting a large and continuous shaving of thirty or forty feet in length, (as may be,) apparently as if it were lead, and which, curling up, forms a curious and perfect worm or screw. From the great pressure of the tool, one of the edges of this screw is frequently split into regular teeth like those of a fine comb, but shorter. The tool, when it has gone from end to end of a shaft or rod, is, by a simple adjustment, made to travel back again, and the operation is continued till the whole is of the required diameter, and perfectly bright and polished. Another interesting operation in this department is the turning and polishing of circular pieces of machinery, whether dished or flat. The tops or lids of the cylinders of large engines are the principal, and some idea may be formed of the advancement of this art, by an inspection of the cylinder tops of the *President*, which are as bright as mirrors, and are 80 inches in diameter! Water constantly dropping on the cutting tool from a small pipe is all the "oil" used either in planing or turning.

The Fitting-up Shops.

There are several rooms in which the "fitters-up" are employed. These finish the smaller brass and iron work of the engines, and have turning lathes, and all manner of hand tools. In the building of an engine, they hold the same relation to the foundry and the forge, that the clock and watch maker (properly "finisher") does to the establishment that supplies him with his wheels and other works in the rough.

The Model or Pattern-Makers' Rooms.

These rooms are extensive, and many first-rate workmen are employed, the greatest exactness being required, otherwise the castings would be unavailable. The timber used is almost wholly well-seasoned deal. Many of the patterns are complicated and beautiful, a great deal of taste being displayed in the mouldings and other decorations, where such can be appropriately introduced. The models are all finished and polished in the best possible manner.

The Model Rooms.

These are a lofty part of one of the buildings, and are well worthy of a visit. In one of them we were fairly lost, amidst many hundreds of bevelled, cog, and other mill wheels, of all possible sizes, (few alike) and piled up to the very roof. Many of these are, we learned, for the purpose of supplying foreign orders. Here, too, are a variety of engine-bed plates, paddle wheel centres, patterns for water and other wheels, &c. &c. all made with mathematical accuracy.

In another room were an immense number of models of great guns, as adopted, in outward fashion, by the English, the French, the Dutch, and others. The models of beams for marine engines, of all sizes, were here piled; also of Ionic fluted pillars for their frames. The models from which the beams, &c., are of the Royal William, and many others, were cast, are here deposited, as are those of the larger engines in the yard below. The collection of patterns of all descriptions is indeed great and excellent, and must have cost an immense sum of money.

The Engines now in course of completion.

The following Engines are now in hand at the works, and the three largest nearly completed:

1 pair of	540-horse power		for the	"President."
1	do.	420	ditto	the "United States."
1	do.	450	ditto	a French man-of-war steam frigate.
1	do.	300	ditto	H. M. S. "Medina."
1	do.	50	ditto	the "Calcutta Steam-tug."*
1	do.	45	ditto	a Government tender.†
1 single engine of	60-horse power,		for	Australia.
1	do.	50	ditto	for a French house.

The President's Engines.

These are the most remarkable for their size, and are really a stupendous piece of workmanship. They are already fixed up, and strike the visitor with astonishment. The castings, and all the workmanship, are of the first description, and the architectural design of the framework, or pillars, is highly ornamental, without any sacrifice to the requisite strength. As probably the most suitable to attain this desideratum, the Gothic style has been adopted. The massy clustered pillars are surmounted by the pointed and moulded arch to correspond. The diagonal stays and their open work are in keeping; and such is the height and imposing effect of the whole, that visitors generally remarked that it strikingly resembled a handsome Gothic chapel. The beams are beautiful castings, as are the cylinders, and both of immense size and weight. The polished iron and brass work is superb, and the whole furnishes a gratifying proof of at once the enterprise and the ingenuity of the men of England. The following are some interesting statistics of this stupendous piece of machinery:

Diameter of cylinder............	80 inches.
Stroke of engine	7 feet 6 inches.
Weight of cylinders	11 tons.
Valve-cases, from	6 to 6½ tons.
Beams (4 in number), upwards of	5 tons each.
Condensers, about..............	10 tons.
Gothic pillars, four pairs, each ..	11 tons, 7 cwt.
Diagonal stays, 4 in number, each	4 tons.
Main, or paddle shaft	9 tons.
Two eduction pipes, each	18 cwt.
Boilers, each	30 tons.
Bed-plates, (two,) each in one casting	15 tons.

* Now building in India.

† To run, it is said, between Dover and Calais.

The whole engines and boilers, with the water, will weigh about 510 tons.

The hoisting-tackle used in setting up these engines is well worthy of notice. On the principals, or lower beams of the roof, which are of extraordinary strength, railways are fixed, upon which traversed scaffolds, railed round, and each carrying a powerful winch. On these scaffolds are also railways, at right angles with those on the beams, so that, by moving the scaffolds and the winches, any spot in the building may attained directly perpendicular to the article to be hoisted, which, by other movements, can be lowered to any given site.

The Engines for the "United States."

These are precisely similar in construction to those of the President, differing only in being a little smaller. No detailed notice of them is therefore required. The cylinders are 73½ inches in diameter, and the power is the same as that of the Great Western,—namely, 420. They are erected in the same shed, or building, containing those of the President, and have been equally admired.

The "Medina's" Engines.

These are of 300-horse power, and, though different in the style of the casting, are also got up in the best manner.

The whole three pairs of engines will be ready simultaneously for shipment; but, unluckily, the want of proper shears to hoist in the machinery and boilers, (there being but one pair at the Canning Dock, and a crane at the Trafalgar,) one or other of the vessels will have to wait her turn.

The pair of 45-horse power engines, for the Admiralty, are also in a forward state; as are most of the others before enumerated.

Such is a sketch of the works at Messrs. Fawcett and Co.'s establishment. We do not remember to have enjoyed a greater treat than in visiting it, and it was with considerable reluctance, that having other engagements, we could not prolong our stay on the premises, and examine some other departments. The whole is a world of mechanism within itself; and though it send forth huge and deadly weapons of war, it also produces maritime machinery calculated to extend civilisation, and to promote the amicable commercial intercourse, and mutual wealth and happiness, of nations scarcely known to each other but by name.

This firm have upwards of 700 workmen. The President will be the largest steam-packet in the world. Messrs. Fawcett and Co. have been applied to by the Bristol Steam Packet Company to make them engines of 600 horses' power each, but their present engagements do not permit of their accepting the order.

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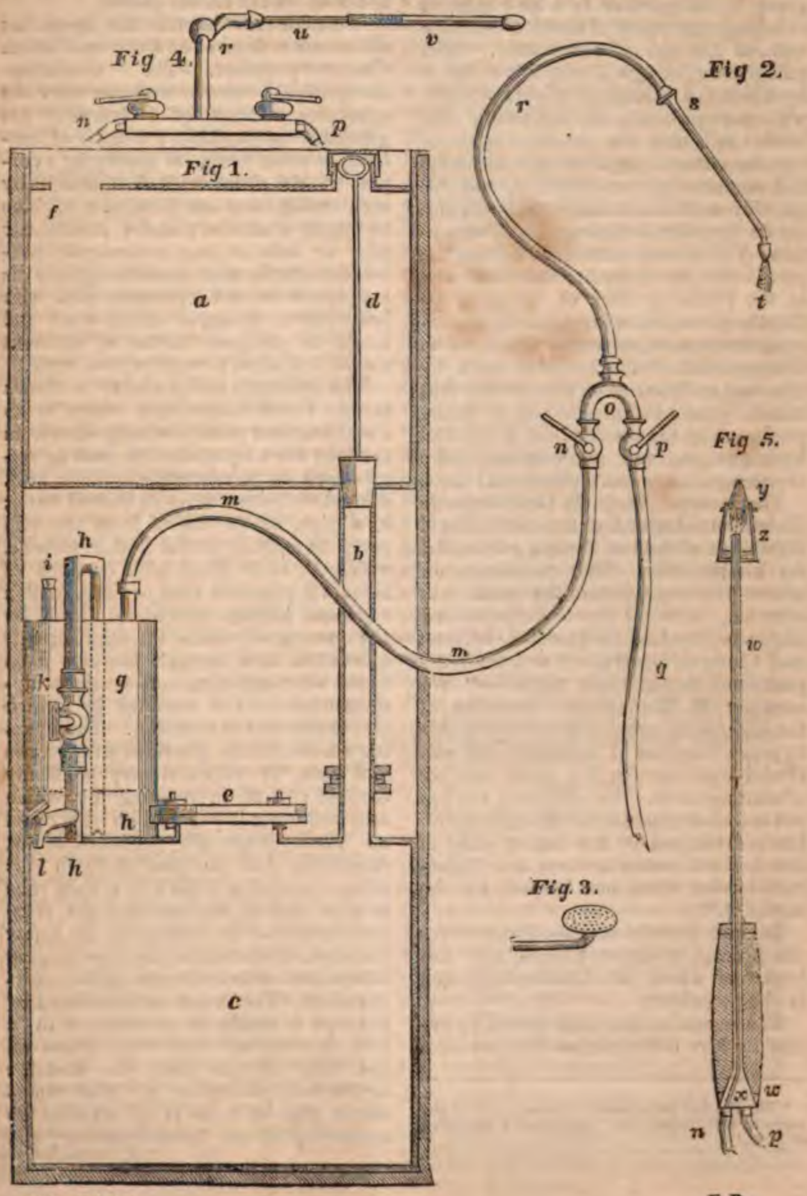
RICHEMONT'S AUTOGENOUS SOLDERING.



M. DE RICHEMONT'S AUTOGENOUS SOLDERING, OR NEW MODE OF JOINING PLATES OR TUBES OF LEAD AND OTHER METALS WITHOUT SOLDER.

"Autogenous soldering" is the term given by its inventor to a new method of joining one piece of metal to another without the use of any solder. The autogenous *junction* of metals is a phrase by which the invention might, perhaps, with more propriety be designated. But be this as it may, the invention is one of vast importance both to our chemical and engineering manufactories, and will speedily work out a name for itself, and for its inventor a distinguished reputation. The process consists in uniting the parts to be joined, by fusion of the metal at the points or lines of junction; so that the pieces, when joined, form one homogeneous mass, no part of which can be distinguished from the rest even by chemical analysis. And this result is obtained by means of intense jets of flame, produced by the combustion of air and hydrogen gas, and are rendered quite as manageable as more substantial tools.

The inventor, Mons. E. Desbassays de Richemont obtained at the last National Exhibition of Arts at Paris, a gold medal for his invention. The committee on whose recommendation the medal was awarded, included those distinguished chemists Gay Lussac, Thenard, D'Arcet and Clement Desormes; and their report concludes in these terms:—"We consider M. Richemont's invention of the highest importance; it is applicable to many branches of industry, and will render signal service to a great number of manufactures. Its efficiency too has not only been established by experiment, but is evidenced by the fact of most of our eminent manufacturers and tradesmen having taken out licenses for the use of it."

Patents have been also obtained for the process in Great Britain and Ireland,* of which Mr. Charles Delbrück is the proprietor.

The invention has been put in operation by Mr. Delbrück, on the premises of Messrs. Andrew Clarke and Sons, plumbers, in Southwark, where we have had the pleasure of witnessing the complete efficiency of the process, as applied to the manufacture of vessels, tanks and other articles of lead, and also sufficient to convince us of its applicability to the soldering of the harder metals.

We shall now describe the apparatus as we saw it fixed and in use on Messrs. Clarke's premises. The "*Chalumeau Aerhydrique*"—as the inventor calls the apparatus, consists of a hydrogen gas generator or producer; a pair of bellows, or other means of supplying a current of air, either worked separately by each workman or one blowing a machine to supply a number; and a caoutchouc pipe or tube of any necessary or convenient length, with cocks to regulate the supply of air and hydrogen, and with brass jets or beaks, of various sizes and kinds, to produce flames of different shapes and sizes to work with as tools.

The hydrogen gas producer is shown at fig. 1 (see front page) which is an elevation, but nearly wholly shown in section; *a* is a square leaden tank or vessel which is to contain sulphuric acid, diluted with seven times its bulk of water; *b*, a pipe, which passes from the acid vessel to another similar leaden vessel *c*, which is to be filled with cuttings of zinc; *d* is a conical plug or cork, with a stalk and handle, covered with lead, by the opening of which the dilute acid is allowed to flow through the pipe *b* on to the zinc cuttings, and produces hydrogen gas; *e* the opening by which zinc is put into the vessel *c*. The opening *e* has a cover, provided with screws and nuts, by which it may be firmly secured; *f* is an opening by which acid and water is poured into the vessel *a*. The hydrogen gas produced as just described, has to pass through the safety-chamber *g*; *h h h* is a bent tube or pipe, which conducts the gas from the vessel *c* to the bottom of the safety chamber, the mouth of the pipe dipping into an inch or two of water in the safety-chamber. This water is introduced by the pipe *i*, which is provided with a cork or stopper. The cock *k* cuts off the flow of gas from the vessel *e* to the safety-chamber *g*. The caoutchouc pipe or tube *m* is screwed on to the top of the safety-chamber, and

* The English patent which was taken out in the name of Mr. Hebert, for "Autogenous Soldering of Lead."

conveys the gas to the beak, tool, or working instrument in the hand of the operator, in connection with a blast of air, as afterwards described.

Gas will continue to be produced as long as the dilute acid is allowed to flow on to the zinc cuttings, and as long as the cock, allowing the gas to issue as it is produced, is open; but as soon as that is shut, a small quantity of gas accumulates, so that the liquid cannot act upon the zinc. It follows that there can be no danger of any explosion, as the production of gas is never more than is required for working; and when the work ceases, the production of the gas also ceases.

When the dilute acid has become saturated with zinc, and no more gas is produced, the discharging tube is opened and the liquid taken out. By crystallization sulphate of zinc will be obtained from this residue, which may be sold at a price which will more than cover the first and daily cost of this new apparatus.

That part of the apparatus with which the workman operates is shown by fig. 2. The caoutchouc pipe *m* is screwed on to one arm of the forked tube *o*; the other arm of *o* is attached to a pipe *q*, leading to a bellows, or other air-supplying instrument. Each man may work a bellows with his foot to supply himself with air, or the men in a whole factory may be supplied from a large blowing apparatus. Some such apparatus as was used to supply air to Beale's patent light would be applicable to this purpose. A cock *n*, regulates the supply of gas; *p* is a cock which regulates the supply of air; *r* is the pipe or tube in which the gas and air are mixed; *s* the beak or tool from which the jet of flame *t* issues, on the gas being united, and with which the workmen operates.

The forked tube *o* is hooked to the girdle of the workman, at a convenient height, and the regulating cocks *n* and *p* are so placed that with one hand the exact proportions of air and gas may be allowed to issue. By stopping both, the flame is of course extinguished. In shutting off, the cock should be shut a few moments before the other, otherwise a slight snapping explosion will take place, but which is not at all hurtful or dangerous.

The beak or tool *s* may be changed for others of every variety of form, to produce jets of flame suitable to the work to be done. We examined a great variety. Fig. 3 is a tool which will produce a most intense flame of jets, like the rosette of a watering-pot. Fig. 4 is an instrument for producing a length of flame instead of a point; *n* is the hydrogen gas-pipe and cock, and *p* the air-pipe and cock; *z*, tube in which air and gas mix; *u* a pipe with a longitudinal slit on one side of it, and another pipe covering *u*, and exactly fitting over it. Gas and air issuing from the slit on being ignited, will produce a long strip of flame, which may be lengthened or shortened by sliding off or on the covering tube *v* on the slit-tube *v*.

Fig. 6 is a soldering-tool, to be used where a jet of flame is not answerable, as in joining zinc. In this the aerhydric flame keeps hot a piece of copper *y*, with which the work is done. *w w* is the tool with a hollow handle and stalk; air being supplied by the pipe *p*, passes through the hollow handle and stalk; *x* is a small tube which passes down the hollow handle and stalk *w*, and conveys gas from the pipe *n* to the extremity of *w*, where it mixes with the issuing air, and on being ignited the flame will heat the piece of copper *y* (which may be of any of the shapes used in ordinary soldering tools), held by the arms *z*.

The following exposition of the advantages attending the use of the apparatus, we translate from a pamphlet published in Paris.

From the description given of the new mode of joining metals, it will be seen that the junction is necessarily secure from the chances of flaw which in the old method were occasioned by—1, the difference of expansion between the lead and its alloys with tin, a difference which is particularly felt in very cold or very elevated temperatures; 2, the electro-chemical actions which are developed under certain circumstances by the contact of two heterogeneous metallic substances;*

* M. M. Vauquelin and D'Arcet have seen in soap works the soldering of vats lined with lead crumble in a few days to a state of powder. The same has been remarked of leaden pipes passing through certain soils.

3, the very powerful reaction which a number of chemical agents exercise upon alloys of lead and tin though not upon lead alone; 4, the extreme fragility of these alloys which particularly when heated break sometimes on the slightest blow; 5, the difficulty of making the solder take and adhere to the surface of the lead where it sometimes only sticks without the workman knowing it; and, 6, the use of rosin which so frequently conceals fractures for a time.

As the method of M. de Richemont is, however, employed by persons upon whose care it is impossible always to depend it cannot be pretended that the autogenous soldering never presents any defects; but then they result *only* from negligence, the nature of the work being such that however little attention the workmen may give to it, they ought immediately to perceive the smallest imperfections: good workmen may therefore always guarantee beforehand the goodness of their work, which the uncertainty of the old method would rarely allow.

We may therefore justly state, without being taxed with exaggeration, that the adoption of the new method of soldering will very much diminish the number of cases of the escape of water and gas, which occasion every day so much inconvenience and even danger as regards the stability of buildings, the maintenance of the public thoroughfares, and the security of life.

The disuse of charcoal and tin, by plumbers, will be an important means of rendering their trade less unhealthy—the exhalations of their brasiers and the arsenical vapours emanting from impure tin, being frequently the cause of serious maladies.

Finally, we may be permitted to add, that if the new method of soldering had been in use, we should not have had to deplore the destruction by fire of the corn-market of Paris, of the cathedral of Chartres, or that of Bruges, which was occasioned by the negligence of plumbers; a negligence for which if the present invention were used there could be no reason, since it is only requisite to turn a cock in order to extinguish or relight, at any moment, the jet of gas which serves for the plumbers tool.

To these various considerations drawn from the public interest, and which alone ought to ensure a preference to autogenous soldering on the part of the Government, the public, and men of science; we will add a few others, which though of a minor importance, are not unworthy of notice.

Such for instance are the advantages presented by this method in an economical point of view.

The total disuse of the alloy of lead and tin now employed will enable the master plumbers to reduce the prices of their work very considerably in many cases, and will prevent as well in regard to themselves as to individuals who find their own materials, those abuses so publicly notorious, which the use of so expensive a material gives rise to, and which, at the same time, so easily escape detection.

The disuse of seams or overlappings, which from this new mode of connecting lengths of lead, will almost entirely be given up, will alone occasion a considerable saving in the quantity of lead employed.

The extreme facility with which lead of from one-thirtieth to one-tenth of an inch in thickness may be soldered and defects repaired, will permit of the substitution of this, in many cases, for thicker lead, and thus diminish the expense; perhaps also it will give rise to the use of lead for purposes to which it has not yet been applied, or the return to others, in which, from motives of economy, it has been supplanted by other metals.

In a purely technical point of view, the art of the plumber will be indebted to M. de Richemont's method for several improvements of high importance. Thus he will be enabled henceforward to make joints internally wherever a jet of flame can be introduced and directed; to reconstruct on the spot, of pure lead any portion of a vase, a pipe, or a statue, that may have been removed or destroyed; to execute one after another any number of successive solderings; to repair in a few minutes without even leaving a trace, dents, cracks, flaws, &c., in sheets or pipes of new lead, or the defects of the autogenous solderings themselves; to do away entirely if desired with the enormous edges or knots left by the old-fashioned joints, and that without weakening them; in short, to give to works of lead a precision of execution,

solidity, unattainable up to this so that this metal shall be available e in all the combinations required e civil and hydraulic engineer, how- omplicated they may be, and in all rnamental forms that the architect lesire to give it.

t there is a class of artisans to the processes of autogenous solder- re more important than to all the namely, those who follow the va- and numerous branches of the ical arts. The possibility of mak- pure lead, vessels and instruments ery form and all dimensions, is for we may boldly assert, an important ment; for in chemistry, particularly ecution of the happiest conceptions een frequently arrested by the im- tion of the means. We therefore it necessary to enter into some par- r details on the application of enous soldering to the necessities ese arts.

will not dwell on the difficulties ienced, even in experimental labo- es in procuring retorts, recipients, basins, &c. of pure lead, which can be accomplished with difficulty and long and expensive process; but to an idea of the importance that prac- chemists attach to the having at disposal large vessels of lead with- lloy, we will remind our readers the *Société d'Encouragement*, who stly appreciate the progress of na- l industry, awarded in the year 1835, d medal to Mons. Voisin for having eded in casting a sheet of lead suf- tly large to make, by raising and ng in the angles, boilers of one and without soldering, applicable e various purposes of the chemical

future there will be no limit to size of sheets of lead in a single , whether cast or in layers, since it only depends upon the number of s that it is desired to unite in one. the boilers necessary for the process idification and the concentration of e solutions may be constructed of lead whatever be their dimensions. same applies to scouring vats *(bacs rocher)*, employed by so many arti- who work metals, crystallising tubs, in general, to vessels of every kind to contain liquids which act upon in solder.

Independent of the advantages which the autogenous soldering offers in the construction of new utensils, in regard to dimensions and form, the facility that it gives for repairing them is, perhaps, in an economical point of view, still more important, particularly for such as are exposed to the action of heat. By the old method, the holes which are so frequently caused in the bottoms of these vessels, either by the action of sudden flames or by deposits that form on their surface, can be stopped only when they are not of too large dimensions, by making what are called weldings of pure lead. The cases in which this mode of repair is possible are very limited, and whenever it is impracticable, the boilers must be taken down, the lead changed, and then reset; operations, the expense of which, at all times considerable, is augmented by the distance from the place whence the metal is procured, from the cost of transport and the longer interruption to business. Now nothing is easier than to apply pieces, whether at the bottom or the sides of the vessels, whatever be the size of the holes; and by this means one may actually renew piece-meal the whole of a boiler. There will therefore never arise a necessity for changing them, except when entirely worn throughout, and then there will be this advantage, that the old pieces, instead of being a mixture of lead and solder, will be free from every kind of alloy, and consequently, will yield at the melting-pot a metal perfectly pure.

The very great ductility of lead, which in many cases is one of its most valuable qualities, is, on the other hand, a great inconvenience whenever we require utensils or instruments capable of offering a certain resistance. At the same time there are circumstances where this metal alone can be employed, on account of the manner in which it resists chemical action. By constructing vessels or instruments of iron, zinc, or even wood, and lining them, either externally or internally, or on both sides at once with thin lead, which can always be done, however complicated their forms, we shall in future have utensils that will resist pressure and blows, and likewise all the chemical agents, as well as if they were entirely made of pure lead. Without entering into a detail of the operations to which this plan may

be most successfully applied, we will mention, by way of example, the production of hydrogen under a heavy pressure, the preparation of soda water and other gaseous waters, the distillation or evaporation of acid or alkaline fluids, under a lower pressure than that of the atmosphere, &c.

It is almost superfluous to add that the various utensils, such as funnels, pumps, siphons, shovels, spatulas, spoons, ladles, measures, stoppers, skimmers, &c., employed in chemical factories, may always, by this means, be made of wood, or metal covered with lead.

Another application that deserves some notice is that of lining common barrels with lead one-sixteenth to one-eighteenth of an inch in thickness. These vessels would be of great utility in chemical factories, more particularly in the construction of the apparatus of Woulf and other pneumatic instruments*, to which greater dimensions could be given by this means; but they could be employed with singular advantage in the transport of acid and alkaline liquids by sea and land. We know, indeed, that all liquid chemical products, and especially the sulphuric and hydro-chloric acids are transported in stone bottles placed in baskets, which, when sent a great distance must, on account of their fragility, be covered with a double package. This precaution is, however, far from being sufficient always to prevent those accidents which the breakage of these bottles would occasion, both in the loss of the acid and its action on surrounding bodies. Thus the exportation by sea, of the sulphuric and hydrochloric acids is limited to a small number of parcels, and is absolutely *nul* in regard to those countries that can be reached only by long voyages—the case of the two French ships that perished at sea, on a voyage to the colonies, in consequence of the breaking of some bottles of sulphuric acid having with good reason alarmed the owners and assurance companies.

By putting these acids into barrels lined as we have stated, and closed by means of plugs of lead soldered, we may effectually escape all accidents of this kind; and the conveyance of these acids will be attended with no more danger than that of any other liquid. These lined barrels offer besides, a considerable advantage over the bottles in single or double cases, in regard to the tare and the bulk, an advantage which must naturally be the greater, from the barrels having a larger capacity, and the quantity conveyed being larger, the selling price will be lower. This will be particularly obvious in the case of hydrochloric acid, the price of which is so low that it will not admit of carriage to places at any distance.

Barrels lined with lead are particularly adapted to keeping acids and other chemical products in store, and we may presume they will, on this account, come into general use among persons who retail or habitually consume these articles; such as chemists, apothecaries, druggists, grocers, &c. By means of cocks conveniently disposed, and siphons or hand-engines of pure lead, similar to those of publicans, these liquids can be drawn and served with the greatest facility, while these operations are always dangerous to persons not well accustomed to them, when stone bottles are employed.

Hitherto it has been impossible to introduce into chemical factories, the system of evaporation by means of pipes heated by steam, because of the action of the acid or alkaline fluids on the worms of copper or lead soldered with tin, which it was necessary to make use of. At the same time the advantage of this system, which has been adopted for several years in different arts, would be still greater, if it were applied to fluids that are evaporated in leaden boilers, such as solutions of alum, copperas, ammoniacal salts, &c.; for, as these boilers cannot be in immediate contact with the flame, but are always of necessity separated from it by an inch either of metal or of masonry, the fuel is far less economically employed in this mode of heating than in any other, and yet every body knows that in the prepa-

* Nothing can be more convenient than the new method of soldering for filling up Woulf's apparatus, and all others in lead, from the facility that it gives for soldering, unsoldering, and resoldering, as many times as may be desired, the pipes, tubes, lids, &c. There is no practical chemist who will not be instantly struck with this advantage; and it is probable that hereafter soldering may supplant in numberless cases the lutes that are now employed and which so frequently *occasion* miscalculations and loss of time and *money*.

ration of the majority of the salts, the expense of fuel is one of the most important elements of the price of the product. The ease with which boilers, or other utensils heated by steam, may be arranged at any height and in any position—with which any form may be given to them without reference to the situation of furnaces—with which the application of heat may be suddenly suspended, checked and renewed at will, and at any period of an operation, by simply turning a cock, will be invaluable in the chemical arts, under many circumstances already known, and in a number of others that may be foreseen—the progress that science is daily making tending to show that the reactions vary exceedingly with different temperatures.

By the aid of the new method of soldering all these advantages will be easily realized, since we can now make worms of pure lead in any shape, of any dimensions, and of any thickness; and if it were necessary to exceed the limits of ordinary pressure for fluids of great density, such as sulphuric acid, for instance, we could no doubt employ a pipe of iron or copper lined with lead, the resistance of which would then be indefinite. With regard to the coppers themselves there would be nothing to prevent the use of those of one-eighth of an inch instead of from two-eighths to four-eighths of an inch, which it has been necessary to use hitherto; and yet we shall be secured from the effects of the fire, which by causing holes, frequently occasion an enormous loss in material, to say nothing of the various expenses enumerated above.

We will conclude with a few observations on the very particular importance of M. de Richemont's method in sulphuric acid factories.

It is well known that the establishments in which this acid is manufactured are composed of a series of chambers or utensils of lead which present generally a capacity of 25 to 50,000 cubic feet, and sometimes from 200 to 250,000. There is not one of these factories the construction of which does not employ many thousand pounds weight of tin solder. The constant contact of the lead and the solder with the sulphuric acid, and particularly with the nitrous vapours, subjects the solder to an action so powerful that in a short time there are so many fissures produced by its destruction as to render useless, if not the entire apparatus, at least some of the chambers which compose it. Thus the manufacturers are burthened every year with repairs and partial reconstructions, which are the more expensive because they bring with them all the cost of demolition, changing the lead, stopping of the works, and resetting the apparatus. No doubt the action of the nitric acid on the lead itself plays an important part in the destruction, more or less rapid, of the chambers; but on the other hand we are correct in stating that they are injured particularly at the parts soldered, and more especially at the angles, where the acids are in direct contact with masses of solder. We are therefore justified in hoping that chambers constructed entirely of pure lead would prove more durable than those soldered by the existing method.

A circumstance that adds to this probability is, the facility with which we shall be enabled in future to repair the slightest damage at the moment it occurs, even while the chambers are at work, provided the part affected be in sight, and thus prevent the increase of holes or cracks, which, when neglected, it frequently becomes impossible to repair without stopping the works, which always occasions a heavy expense. The constant examination and preservation of the lead work will be the more easy under the new system, since it permits the adoption of a mode of finishing and setting, by means of which almost the whole of the angular joints, and generally the vertical ones, are made on the outside of the chambers. The *Chalumeau aerhydrique* being besides always in readiness, and as its flames can be conducted without even deranging the instrument, to a distance of several fathoms from the place where it stands, people will no longer be disposed, as before, always to delay repairs apparently insignificant, for the sole reason that it was necessary to light a brasier, to heat irons, to melt masses of solder, and sometimes to disturb several workmen, to carry the whole into the centre of some complicated carpentry,—difficulties that are of great weight in practice.

What we have before stated respecting the advantages arising from the disuse of seams, will apply particularly to chambers for sulphuric acid, in which this mode of soldering is employed. But this advantage, although very great, is here but little in comparison with that resulting from saving the whole of the solder; and if we add that in most localities the use of gas offers a considerable reduction in the expense of fuel, and that there is also a great diminution in the work of the men, it will be seen that if the manufacturers of chemical products really know their own interests, there will not henceforward be a single sulphuric acid chamber constructed or repaired on the old system. In fact, the manufacturers of Paris were so sensible of this, that even before Monsieur de Richemont's method had attained any kind of publicity, they came to him to treat for its introduction into their establishments, and since that time the system has been adopted in the greater number of the sulphuric acid factories of the north of France. Among others, M. Gay Lussac (the Faraday of France) has taken a license for the establishment of St. Gobins, which is under his immediate superintendence.

Independently of its application to the autogenous soldering of lead, the flame of the Aerhydrique blow-pipe may be employed directly in using for solder either the common alloys or pure lead to unite zinc and iron and lead with iron, copper and zinc.

It may be substituted also with the greatest advantage for the common blowpipe and the lamp of the enameller in all their applications to the soldering and joining performed by the aid of these instruments, by jewellers, goldsmiths, tinmen, manufacturers of plated goods, of platina, of buttons, &c.

This will readily appear if we reflect that while hitherto the parts soldered must of necessity be carried to the flame, it is, on the contrary, the moveable flame that is here conducted at will by the hand, to all the points that are to be exposed to the action of heat, whatever may be their position. On the other hand, the jet of the Aerhydrique blowpipe being susceptible of infinitely greater power, may be applied to works of much larger dimensions, and on this ground it may be usefully employed in certain cases, by braziers, copper-plate workers, locksmiths, tinmen, &c. As the sphere of action of the heat necessary to effect the fusion of the metal, can always be limited at will, one need never be afraid, while welding or soldering one part, of melting the part adjoining, and hence a very great facility in finishing a multitude of delicate articles, and above all in effecting repairs that were heretofore impossible.

The applicability of this mode of soldering to the tubes of locomotive engine boilers, is deserving of particular notice. Not only can the flame be conveyed to the parts required to be soldered with great convenience, but the flame is free from those sulphureous admixtures which are unavoidable when the metal to be soldered is brought into contact with the vapours of burning coal.

There is another peculiar application of the flame produced by the combustion of gas, that has been effected by M. de Richemont, which it is not irrelevant to mention here; it is that of heating by this means soldering irons, (see fig. 5), such as those used by tin plate workers, zinc workers, plumbers, tinmen, &c. A few seconds suffice to bring the iron thus heated to the desired temperature, and it can be kept at that temperature for whole days without being liable to burn, the workmen having nothing else to do but to regulate the flame by means of cocks, and not being obliged to change his iron or even to leave it for a single moment. Hence a considerable saving in manual labour, to say nothing of that in fuel, which will vary with the comparative value of the gas that can be procured, and that of coals, but which, in Paris for instance, will be always one-half of the present cost.*

* It is calculated that in London if the common gas which is employed for lighting the houses and streets, be used for heating soldering irons, the cost for each workman during a day's work of twelve hours, would not exceed three halfpence, and for each zinc worker two pence halfpenny.—*Trans.*

COOKING BY GAS.

Sir,—I have just seen in No. 866 of the *Mechanics' Magazine* a communication from Battle relative to cooking by gas.

Has your correspondent been asleep for the last ten or twenty years? Is he just awaked from a trance in utter ignorance of what has been passing around him?

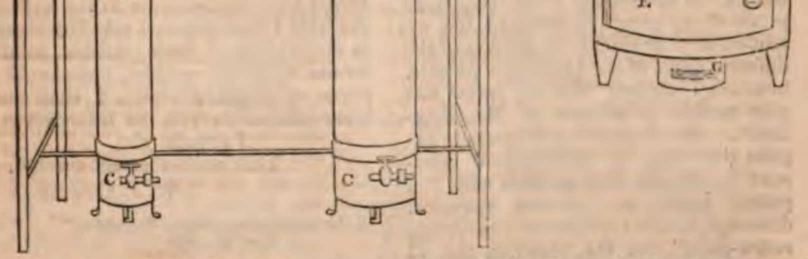
Has not cooking by gas been blazoned abroad by all the newspapers? Has it not been the subject of public lectures in Mechanics and other Institutions? Have not numbers in different places partaken of the viands cooked on the table of the lecture room? Do I not myself recollect that some years ago I officiated as Vice P. when fifty or sixty persons sat down to a public supper cooked by gas in their presence? Can I not testify to the delicious flavour of the brown yet juicy slices which on that occasion I carved from a splendid piece of roast beef, to say nothing of the boiled and the steamed, the fish and the fowl, the mutton and the pork, the puddings and the pies, each and all excellent in their kind, although all cooked by the lecturer by way of exemplification while delivering his lecture, and that without the slightest odour being perceptible in the room to betray what was going on. To such perfection has the art of cooking by gas been brought, by the ingenious manufacturers and vendors (and for ought I know inventors) of the apparatus, Messrs. Sharp and Co. of Northampton, whose prospectus I enclose. Messrs. Sharp and Co. have regularly manufactured and sold it for nine or ten years past, and so have numerous copyists in various partsof the kingdom; and for nearly half that period has the apparatus of Messrs. S. been in use at the Herald Coffee House, Shoe-lane, Fleet-street, besides many private establishments.

I can hardly imagine how any person who has paid the least attention to the subject could imagine himself to have invented an apparatus which has long been regularly made and sold in different parts of the country. Why, Mr. Editor, at this rate we shall soon have some gentleman discovering the applicability of gas to the lighting of streets and shops, and communicating the important intelligence to the public!

I am, Sir, respectfully,

AN OCCASIONAL READER.

RICKETTS' GAS COOKING APPARATUS.



Sir,—I send you herewith a rough *sketch of a gas cooking* apparatus made *for me by Mr.* Ricketts, Agar-street, Strand, London, which appears more useful and certainly very much more economical in use than the one described

by your correspondent Mr. Weller; for I have a round tea kettle with concave bottom, and in this I can boil over my 5 inch burner, 4 quarts of water in 15 minutes, consuming 2 feet of gas, value one farthing. My portable oven will bake as well as any epicure can wish; it will hold 10 lbs. of meat, and the boiler above it, 2 fowls and a vegetable tray; it is heated at the same time and from the same burner as the oven, consuming 8 feet of gas per hour; thus cooking a substantial family dinner for about two pence. My smaller burner consumes 3 feet of gas per hour, and this I find very useful for stewing.

Yours, most obediently,

P. O. CONNER.

Dublin, March 25, 1840.

Description of Apparatus.

A, an iron table 2 feet 4 long, 1 foot 2 wide, and 2 feet 8 high.

B B, diluted gas burners for uniting a jet of coal gas with atmospheric air.

C C, cocks with unions for attaching to the gas supply pipe.

D, iron stand or trivet for stew pans, tea kettle, &c.

E, portable oven.

F, tin boiler with steam tray inside for vegetables.

G, small wove wire door for lighting burner.

H, fret work between top of oven and bottom of boiler for escape of heated air.

CURTIS'S TRAVERSING SCREW-JACK—ENGLAND'S ALLEGED PIRACY.

Sir—In my letter to you of the 19th March, on the subject of Mr. England's piracy of my patent, I directed the attention of your readers to the fact of the different dates of our respective patents, in which I showed that my patent was nine months in advance of Mr. England's. Mr. England endeavours to explain this away by unsupported reference to private arrangements with "a patent agent, an eminent engineer, drawings, and an experimental traversing screw-jack," and the assertion that all *this was done* five weeks before my *specification* was enrolled, whilst the fact *stares him in the face,* that his patent is *dated* May 7, 1839, nearly three months after my specification was enrolled; and you are aware that a patent is obtainable in three weeks after the declaration is made. Mr. England prudently leaves the identity of construction and object which I pointed out, undisputed; in fact he admits it when he prays for an immunity from attack on my part, he "having made a machine calculated to attain the same object, but by different means," which "different means" being *equivalent* means, establishes my right beyond all question.

And now for facts:—I refer to Mr. Gooch, and every engineer and stoker upon the Great Western Railway, for a corroboration of my statement, that England's jack upsets when it is attempted to traverse the load by means of the lying screw.

I refer to Mr. Wood, of the South-Western Railway, for the facts I stated with reference to the proved uselessness of England's jack upon that line.

I refer to Mr. Richardson, of the Croydon Railway, for what I stated with reference to England's jack upon that line.

I refer to the chairman and board of directors of the Croydon Railway, as witnesses of the perfect action of my traversing jack, in an experiment which was made with it in their presence, on Tuesday, 26th of March last. The machine used I find to be the same that was most successfully employed as I stated, upon the evidence of one of the men engaged, on the Great Western Railway, but which I withdrew rather than dispute a question of payment; for which fact I, refer to Mr. Seymour Clarke, of the Great Western Railway.

That Mr. England should have received an extended order in the teeth of the facts I have stated, I take the liberty to doubt; but I have written to Mr. Brunel upon the subject, and should it prove as England states, I shall then know what to do with the information.

I remain, sir,

Your most obedient servant,

W. J. CURTIS.

15, Lower Stamford-street, Blackfriars, April 21, 1840.

THEORY OF THE UNIVERSE.

l such a notable discovery have been re-
or these modern and degenerate times?—
Oration.—(See Sydney Smith's Works.)

—As the pages of your valuable
ine are not adapted for religious
thological discussion, it will be
to observe that the ancient hea-
are supposed to have deified pro-
. They made their chief deity of
erty believed to be resident in the
or firmament. And Moses, de-
of bringing back the straying Is-
to the worship of the true God,
s this property or chief god of
athen as a fluid (in light), a created
To avoid the various interpre-
which are now given to the word
I shall henceforth call this light,
ental fluid, as also to distinguish
sun-light, fire-light, &c. &c.
the development of my theory it
essary to take a slight review of
gress of creation as described by
Writ.

t, we have a liquid.* Chaos.
ndly, liquid and fluid. 1st day.
dly, the division of the liquid into
above and below, and the for-
of the firmament. 2nd day.
thly, the waters which were be-
e firmament changed into seas
ry land and vegetation. 3d day.
ly, separation of the seas with
nd and vegetation into distant
Sun-light. 4th day.
ly, animal life. 5th day.
animal life commenced true lo-
on.

being sufficient for mechanical
on, I shall make no further al-
to Holy Writ, than may regard
lowing extract from one of our
ed divines.

ny of our most learned divines
that time, according to our pre-
koning, did not commence until
was completed."—*Hakewell.*

y of absorption and exhalation.
theory assumes that the firma-
onsists of globes more or less
nd of a fluid. It further as-
that all the globes are replete
egetable and other matter en-
ith vitality. It then presumes
growth of this matter (in consequence of its vitality) makes each globe absorb a quantity of the firmamental fluid, and that this absorption causes the effect hitherto attributed to gravity. It presumes also that with the demise and decay of vegetable and animal existence the firmamental fluid becomes an exhalation. Its scene of action is supposed to commence from an undefined depth under the surface, to an extent of circumference proportionate to the quantity of absorbed firmamental fluid, and such exhalation is assumed to produce the effect of repulsion. The scene of exhalation being so very extensive, and the minutest particle of matter that has ever possessed life being liable to it, the entire firmament must be traversed in every direction by these exhalations, and thus become an active medium for the transmission of sound, perfume, &c. &c. This would account for the extreme elasticity, or rather expansion of the air.

If we attribute to absorption and exhalation the same powers that gravity and repulsion are supposed to possess, and refer the cause of absorption and exhalation to the growth and decay of vegetable and animal existence; we present life, as the secondary cause of all motion whatsoever. Would this be too bold an assertion? I think not. The exhalation of a stationary globe only could produce the effect of sunlight—the straight lines with the globe necessary for that effect, being destroyed by the progression of a globe in a circle.

Of course this theory cannot disagree with calculations which have been made from effects. They must, in every case, continue the same; but it accounts for many things as yet unaccounted for.

My paper was opened by a *Smith*, it shall be closed by a *Locke*.

"He who would find a truth must leave the beaten track."

Yours, &c.,

E. A. M.

January 30, 1840.

* fluid being of a nature of which we have
ith the exception that it must have been
f perfect equilibrium.

LETTRES SUR LES REVOLUTIONS DU GLOBE, PAR M. ALEX. BERTRAND, M.D., &c.*

In the introductory part of this work the author combats the opinion of those who have been inclined to regard the

* Bruxelles. Dumont, (Edit. v.)

traces of extinct animals existing in a fossil state as mere *abortive* attempts at creation. He endeavours to show that such animals must have been *alive* at some period, and capable of maintaining existence, as at present.

Mr. Kirby, in his Bridgewater Treatise says, it does not appear to be distinctly made out that extinct animals have formerly lived at the very places where their remains are now found in the fossil state. M. Bertrand, however, seems to think that this point is established. He says first, that the diversity of the nature of the layers which cover their bones attests *that* of the revolutions of which they have been the victims (and excludes in consequence the idea of a single grand irruption which has been able to disperse them.) If they had been transported by the water, they would be like all bodies which have suffered this transport, worn away in some degree by the friction, (*frottement)* as we find pebbles to be *rounded* by the action of the waves. Secondly, since we always find the bones of many different animals *mixed* together, and seldom a whole skeleton of any one by itself, this fact again is in favour of their not having been transported by the sea to the places where we find them. (Letter X. page 134.) Now, it appears to us that the first reason assigned is scarcely worthy of consideration; and that the second is rather favourable than otherwise to the idea that they have been carried by the sea to the places where we find their fossil remains. For does it not seem probable that whichever direction the water took, it would bear a great many animals away together all to the same part, and consequently that their bones would all be mingled together? We do not mean to assert that the animals have not lived where their fossil remains are found, but we think more evidence of the fact is wanting than M. Bertrand has produced. He argues that the deluge must have been *very sudden* since an elephant was found in Siberia entombed in ice, with a great part of its skin and flesh in perfect preservation.

It seems pretty well established that *no fossil* remains of the human species *have* yet been discovered. M. Bertrand *tells* us (p. 171) that this is likewise the *case* with the numerous family of apes. In reference to the theory of successive development (Davy's Consolations in Travel), this appears a curious fact, since these animals approximate in structure so nearly to ourselves.

M. Bertrand (p. 175) thinks that *at present* the conditions requisite for *fossilization* do not exist.

It appears by Cuvier's researches that the fossil remains of *marine* animals differ as much from the forms existing at present, in the same parts, as do those of land animals from their successors. (p. 195.) In fact the sea like the land seems to have changed its inhabitants.

M. Bertrand thus announces the law of "successive development" already referred to. "*That fossil animals differ so much the more from beings that live at present, in proportion as they are enveloped in the most ancient strata of the globe*" (p. 200.) According to this view the class of reptiles were the first that came into existence, and after them the warm-blooded animals. M. Bertrand says that Brogniart's researches tend to establish a similar position (viz. that the most simple species were first created with regard to vegetables and plants. (p. 237.) As the reptiles of that period were much larger than at present, so likewise were the ferns. (p. 238.) At the period of the coal formation (*i. e.* in the earliest periods), Brogniart thinks that the earth was very considerably hotter than at present; that the heat was more uniformly distributed over its surface; and likewise that the proportion of water to land was much greater than we now find it to be.

We may observe of this theory, which seems to be supported by many facts, that it is in perfect consistence with the idea of the existence of alligators and reptiles in great abundance at such periods, since these now only live in the *hottest* parts of the earth. Montlosier (a professed Catholic) in his "Mysteres de la vie humaine," does not hesitate to urge the much greater heat of the earth formerly than at present as the proximate cause of life. On this view of the subject we should expect—as geological researches appear to suggest—that alligators and animals that can only live in the hottest climates, would be the first to come into existence. But heat seems only one of the conditions essential to life, and not the cause in any case.

ON MALTING AND THE EVILS OF THE PRESENT SYSTEM OF FISCAL REGULATION. BY GEORGE ADOLPHUS WIGNEY, ESQ.

Sir,—I have been a purchaser and close reader of your work from the commencement of its publication to the present period, and although its pages contain but little on the subjects of malting and brewing, yet as a theoretical maltster and a practical brewer, I conceive myself much indebted to it for scientific and mechanical information, available by appropriation to the improvement of malting and brewing; and having freely received, I am desirous as freely to give some useful hints to others, and to place before them some valuable and important improvements which may be, or have been, effected in either process. And as the manufacture or purchase of good malt is a preliminary requisite to the production of good beer, I will, with your permission, first submit to your readers a few observations on the subject of malting.

Two formidable barriers are at present opposed to an effective and general improvement in the process of malting, —legislative interference, and operative ignorance. Apparent cupidity induces the former, and parsimony causes the latter. As malt is subject to the payment of duty, it is either the real or imaginary interest of the Executive to raise as large an amount as is possible, and it is the manufacturers real or apparent interest to pay as small an amount as possible, and the endeavours of both parties to effect their purpose, are inimical to the production of good malt. The Executive have encompassed the manufacturers with compulsive, restrictive, and prohibitory regulations, and inflict pains and penalties upon their non-observance, and in the establishment and enforcement have evinced a scientific knowledge of the subject of malting, by ingeniously framing them on the best adapted principles to prevent all improvement of the system, to raise the greatest possible amount of duty on the quantity manufactured, to cause a superfluous quantity to be manufactured as a compensation for the diminished extractive product resulting from an inferiority in quality, induced by their restrictive and prohibitory measures, and to defeat the manufacturers' every attempt to evade and avoid them. It must be obvious to every intelligent mind, that as Nature performs all her operations with admirable skill, and the results are stamped with perfection, so must it be desirable that man should scan her works with intellectual perception, and endeavour to assimilate his works of art as near as possible to her performances, by the adoption of measures of an approximating similarity. The art of malting in the malthouse is a feeble effort, imitative of the natural process of germination in the field. Omniscient, omnipotent, and unerring Nature! the operative in the latter; and ignorant, unlettered man, the workman in the former; and vast as is the difference in the discernment, the power to perform, and the wisdom to direct, of the inimitable and the humble imitator, so is the difference in the productive results; and that difference is magnified by the restrictions and prohibitions of the keen Executive, and increased by the unscientific attainments of the working maltster.

The charge of apparent cupidity against the Executive is, because they appear to have established a variety of regulations at direct variance with the most suitable means to produce the best malt, and because they appear to be intended to enhance the charge for duty, regardless of the manufacturer's and the consuming public's interest.

The charge of parsimony lies against the generality of brewers, because they will not seek the aid, and reward the researches of scientific men in the pursuit of experimental inquiries on the subject of malting, which if sought and remunerated, would soon lead to the diffusion of that elementary knowledge of the subject of germination among working maltsters, of which they are now universally destitute; and the payment of more liberal wages to such as excel in the process, would soon induce an educated class of workmen to seek an employment which might prove remunerative to those who possessed the requisite knowledge and skill.

Nature by intuitive suggestion has prompted man to select for the growth of barley a light, friable, and porous soil; or if he has not the means of se-

lection, to adopt those measures which are the best calculated to render it so; and she has induced him to well plough and pulverize it, in order that the matrix in which the grain is to be deposited, may be the best adapted for her future labours. She has also instructed him to choose the month of March, in which to plough, to harrow, and to sow, in order that the earth may be well pulverized; and to facilitate the operation she sweeps the upturned surface with her drying winds. The grain imbedded in her germinative womb slowly and gradually absorbs a portion of the small amount of moisture which the soil contains; its body expands, it inhales the atmosphere, and its germinative functions are awakened into life. But the maltster does not imitate the farmer in the deposition of the seed; he does not place it in some scarcely moistened substance, and pervious to the air, and therein leave it to the fostering care of Nature; but he deluges it with water, by immersion in the cistern, and instead of approximating his system as closely as is possible to that of Nature, by causing the grain to absorb but a small amount of water, and that continually, he is prompted by his own ignorance, and the compulsory enactments of the legislature, to keep his grain in steep for a period of not less than forty hours, whereby it is able to obtain frequently as large a supply as is sufficient for the entire demands of the germinative process, as far as it is consistent that it should be conducted in the malthouse.

To any reflective person who views a field of ripened grain, the question must be naturally suggested to his mind,—from what source besides the single imbedded grain, and by what means are reared the root, the blade, the towering stalk, and crowning ear well filled with many a similitude of the parent stock? And reflection must teach the enquiring nind that while the work of reproducion lasts, an atomic portion of the oriinal seed must pervade the stately stalk nd all the numerous offspring; and uus concluding, he perceives at once ne necessity for the slow and tardy toil Nature, in the work of trivial abraction and immense accretion; and would such person be a maltster, he ay derive an admirable lesson from the ntemplation, and endeavour to approximate his system to that of Nature's, as closely as the compulsory, restrictive, and prohibitory enactments of the Excise will permit, and a variety of contingent circumstances will enable. His reflections will necessarily induce a desire to ascertain the composition of the grain, the various laws which govern, regulate, and control, the mutations of the several substances; and as nothing but earth, water and air are the sources from which are derived the elementary principles which by accretion to the original seed, furnish all the alimentary materials for the future plant, he finds that an extension of his inquiries is requisite, in order that he may comprehend the composition of those elements, the adventitious substances blended with them, and the atomic laws which direct and regulate the accretion and abstraction of atoms to and from the original seed. He will also discover that the farmer under the suggestive influence of Nature, has sown his seed early in March, and that she has withheld her genial showers until the month of April, well knowing that the infant germ, when first awakened into life, needs but a small supply of nutriment, and therefore she defers the frequent and abundant rain, until the root and acrospire have attained to magnitude, and need more copious sustenance. But diametrically opposed to this self-evident judicious course, the maltster is compelled by an arbitrary law to reverse the order of Nature, and saturate his corn to plenitude before its vital principle is awakened; for instead of being allowed to imitate her system, to moisten first, and then to steep, he is obliged to steep first, and not subsequently to moisten, unless he chooses to comply with the insulting and most inconsistent permission, to sprinkle his grain upon the floor on the sixth day, provided he first steeps it 50 hours. And who will say that this injurious law is not founded in cupidity? To those who are not acquainted with the subject, the existence of this anomalous law may appear most strange and unaccountable; but not so to the initiated, for they well know that the keen and lynx-eyed legislature are fully aware that provident Nature toils for the welfare of all her children, and not for the Exchequer purse; and therefore they

endeavour to thwart her purpose, and nullify the judgment and skill of those, who best would imitate her labours.

The malting salesman who is able to appreciate the fact, that the welfare of his trade is dependent on the satisfaction derived by the consumers of his manufacture; and the brewing maltster, the welfare of whose trade is dependent on both the quality and quantity of the extract obtainable from his malt; as well as the malt purchasing brewer, and the consuming public are all deeply interested in obtaining the repeal of this compulsory, restrictive, and prohibitory regulation. The adoption of a more liberal system by the Executive would, I conceive, prove ultimately more profitable to the revenue, as the removal of all restrictions would induce some enterprising individuals to endeavour to improve the system of malting, and the success of such an undertaking would promote an additional consumption of malt, both by the brewer, the distiller, the vinegar maker, &c.

The ostensible motive for the establishment of such a regulation, so absurd as relates to the process of malting on the best principle, but so ingenious as relates to the effecting the greatest charge for duty on the smallest amount of extract obtainable from malt, is, that it is for the prevention of illicit malting, and under this plea the honest maltster is to be punished for the dishonest, by being compelled to manufacture on principles opposed to the dictates of his judgment; and both the malting and the malt purchasing brewers are prevented from furnishing to the public so good a beverage as they might, or to derive those pecuniary advantages which the exercise of judgment, skill, and industry fairly entitle the possessors to.

In order that those of your readers who are not brewers, may perceive the result of such a fiscal regulation, it is necessary to point out to them that the sole purport of converting grain into malt, is to effect the transmutation of as large an amount as is possible of the several substances of which that grain is composed into saccharum (sugar) for the ultimate purpose of converting such saccharum into spirit in the process of fermentation; and again by that transmutation, *to render the* content of the grain much more soluble than it is in an unmalted state. Hence it must be obvious to every reflective person that as the production of the largest amount of saccharum enables the creation of the greatest quantity of spirit — as thepurport of the fermentation of malt extract is to create spirit—and, as well fermented beer is found to be much more salubrious than such as is crude and incomplete — so that system of malting which is calculated to produce the smallest amount of saccharum must prove the most unprofitable and disadvantageous to the consumer of the beer produced, and to the intervening manufacturers who furnish the materials and conduct the processes which furnish it. It is necessary also to point out, that the majority of public brewers cause the appropriation of a definite amount of malt extract to every barrel of beer which they send out, in proportion to the price which they charge for it, and the minority make it a rule to obtain a definite quantity of beer from a quarter of malt, regardless of the amount of extract obtained; hence, in the first case, if the brewer is not able to obtain a *maximum* amount of extract from his malt, in consequence of an inability to manufacture that malt on the best principle, owing to legislative restrictions, he either sustains a pecuniary loss, or throws that loss upon the public, by a reduction of the quantity of extract per barrel which he would otherwise allow; and in the second case, the public is sure to be visited with the loss. In either case the public are equally interested with the maltster and brewer in obtaining a repeal of these obnoxious regulations—the compulsion to steep not less than forty hours, and the restriction to sprinkle earlier than on the sixth day, or the prohibition to sprinkle the grain on the floor at all, unless that grain has been in steep fifty hours.

And what is the apparent or real motive for this regulation? The reply is obviously this—that as the duty is charged on the grain after it is steeped, instead of before, with a definite yet arbitrary allowance for the increase in bulk resulting from steeping; and as it is the duty and practice of the Excise to charge the duty upon the greatest gauge or bulk which they can discover, (subject to the varying allowances pre

scribed) during any part of the malting process, so is it evident that the larger the quantity of water which the grain imbibes the greater will be the bulk of the grain, and consequently the greater will be the amount of duty to which it will be subject. And again—as the greater the departure from the germinative system of Nature is in the malting process of the maltster, so must be the diminution in the amount of the saccharum created by the latter, and the inferior predisposition to extensive solution of the component substances of the grain; and as therefore the malting or purchasing brewer of such malt must manufacture or purchase a greater quantity of malt as an equivalent for its inferior production, so must the Executive obtain a much larger amount of duty (in the first instance) by the establishment of those regulations which cause the maltster to make those deviations from the course of Nature which a sound judgment and freedom of manufacture, would deter him from pursuing.

Conscious that these observations are of sufficient length on such a subject as to induce an expectation of their insertion in the valuable pages of your work, I refrain from offering more, but propose, with your permission, to offer in my next to your readers such as may appear to me to be useful, if not interesting, on the subject of malthouses and breweries,

And am, Sir,

Your obedient servant,

G. A. WIGNEY.

Brighton, April 11, 1840.

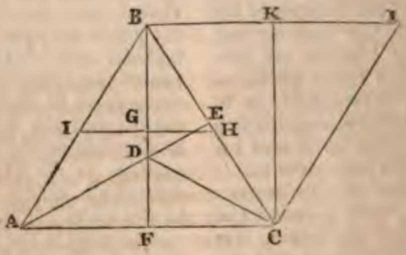
NOTICE OF A REMARKABLE PRIMARY PROPERTY OF THE EQUILATERAL TRIANGLE, BY WILLIAM S. VILLIERS SANKEY, ESQ., M.A.

Sir,—I have thought that the following property of the equilateral triangle proved independent of parallel lines, and involving no proposition of Euclid beyond, at least, the 14th of the first book, might be interesting to your readers, as tending to establish the doctrine of parallels without the assumption of what is called the 12th axiom.

Proposition.

In every equilateral triangle an isosceles triangle can be cut off which shall have each of the angles at the base, equal to *two-thirds of a right angle.*

It can easily be shown by Prop. 4 and 8 of book first that, if in any equilateral triangle, A B C, we bisect the angles (prop. 9) at A and B by the lines A E

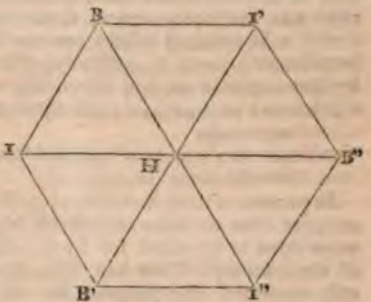


and B F, and from the point of intersection D we draw the line D C to the remaining angle at C, then we shall have three triangles, A D B, B D C and C D A, equal in all respects to one another; consequently the three angles at D are equal, *namely* the angles A D B, B D C, and *C D A; therefore* each of them is equal to $\frac{1}{3}$ of four right angles; but it can be also readily shown that the line A E bisecting the angle at A bisects also the side B C in E, and is perpendicular to it. Hence it follows that the angle B D C is bisected by D E and consequently the angle B D E is equal to $\frac{1}{6}$ of 4 right angles or $\frac{2}{3}$ of a right angle.

from the bisecting line
G equal to B E, the half of
nd in the side B C take
D and join G H. Then
angles D B E and H B G,
in the one equal to two in
ly, B D=B H and B E=
gle at B common; con-
maining angles are equal,
G=B D E=$\frac{2}{3}$ of a right,
B E D equal to a right
, on the side B A, take
l join I G, and here also
iangles G B H and G B I
B H and B I equal and
and the contained angles
I equal by bisection; con-
maining angles are equal,
=B H G=$\frac{2}{3}$ of a right
angle B G I=B G H=a
erefore the lines I G and
irectum, and the triangle
sceles triangle having the
base each equal to *two-*
t angle. *Q. E. D.*
ny equilateral triangle, if
ndicular to the base we
ach that the part of the
ntercepted between this
vertex, be equal to *half*
qual sides, and through
a line perpendicular to
lar, and meeting the sides,
s above an isosceles tri-
he angles at base, each
ht.
this it might be some-
hat, supposing the equi-
infinitely small as the
ase of this equilateral tri-
he base of the isosceles
d ultimately coincide,
ngles of this equilateral
each be $\frac{2}{3}$ of a right
r sum=*two right angles.*
pposing the equilateral
(in the figure) to repre-
itely small equilateral
in the right angled tri-
rmed by letting fall the
B F, we shall have the
al to two-thirds of a right
angle F B C equal to one-
, giving the sum of the
ght angled triangle, equal
gles. Now, describing
another equilateral tri-
ng fall from C a perpen-

dicular C K upon B L, we have in like manner the right angled triangle B C K having the angle B C K=$\frac{1}{3}$ of a right angle, and the C B K=$\frac{2}{3}$ of a right angle; consequently the angles F B K and F C K are each right angles, therefore the quadrilateral F B K C is a rectangle. But it can be satisfactorily shown that, if the theoretical formation of *any* one rectangle can be demonstratively proved, the doctrine of parallels will be completely established by taking multiples of the rectangle *ad infinitum*, &c.

It is a curious fact, that by means of the isosceles triangle I B H, with its angles at the base, each equal to *two-thirds* of a right angle, we can easily form an equilateral hexagonal, thus:—On I H form an equal isosceles triangle I B′ H and on B H another equal isosceles triangle B I′ H, the lines B′ H and I′ H will be *in directum* on account of each of the angles I′ H B, B H I, and I H B′, at H, being equal to two-thirds of a right, consequently their sums will equal two right angles. Now



produce B H to I″ so that H I″=H I and I H to B″ so that H B″=H B and join I′ B″, B″ I″, and I″ B′, and the hexagonal figure I B I′ B″ I″ B′ will be *equilateral*, each side being equal to a side of the isosceles triangle; the alternate angles will be equal—the angles at B, B′, B″, being equal to twice the angle of the original equilateral triangle, and the angles at I I′ I″, equal to $\frac{2}{3}$ of a right angle—also the diameters will be equal, each being equal to the sum of one side and the base of the isosceles triangle, or B H+H I.

It is obvious that with H as a centre, and H B or H I as semidiameter, we could form the regular equilateral and *equiangular* hexagon which we could

prove to be equal to that now constructed and to one another, if we were in a position to prove B H=I H.

I might pursue this interesting subject further, but it would carry me beyond the main object of this communication.

I am, Sir,

Yours, truly,

WILLIAM S. VILLIERS SANKEY.

30, Harmood-street, London.

LIFE AND LABOURS OF TELFORD.

NO. V.

Highland Roads and Bridges.

Previously to the year 1732, the so-called roads in the north of Scotland were mere trackways, scarcely passable even by the natives, and not at all recognizable as "roads" by the men of the south. The rebellions of 1715 and 1745, however, drew the attention of the government to the subject, and the formation of the celebrated lines of military road was the consequence, those wonderful achievements whose renown has been handed down to never-dying fame by that exquisite poetical inscription:

> "If you had but seen these roads *before* they were made,
> You'd have turn'd up your eyes, and bless'd General Wade!"

In process of time, however, something superior even to these remarkable highways came to be called for by the voice of the country. They had, indeed, not only answered the purpose for which they were originally constructed,—that of reducing the turbulent Highlanders under the power of a regular government, but they also incidentally served to show the very great *pacific* importance of such lines of communication, in promoting the welfare of the districts through which they penetrated. It is not therefore to be wondered at, that when the course of events had superseded the reasons which originally led to their establishment, the military roads should yet be retained for commercial purposes, or that considering the benefits they had conferred, a general desire should arise for some extension of a system which *experience* had proved to be so advantageous.

Accordingly, at the same time that the formation of the Caledonian Canal was determined upon, a Parliamentary Commission was appointed for the improvement of the Highland roads and bridges, and to this Board Telford acted as the engineer. The Commissioners commenced their labours in 1803, and the more important part of their operations, extended over the ensuing eighteen years, in the course of which time very nearly a thousand miles of road were constructed, chiefly through the most rugged and inaccessible parts of the Highlands, which were thus thrown open to the rest of the kingdom, and the way made plain for the further march of improvement. This, indeed, has so rapidly followed, that it is not too much to regard the operation of the Commission as having totally changed the face of the country in all the northern parts of Scotland.

A Highland road differs essentially from those of a less wild and mountainous region; its engineering details in particular vary greatly from those of a lowland line. As they are chiefly intended for the passage of cattle, and not wheeled carriages, they are required to be of a much softer surface; their breadth is small, and the nature of the country requires that they shall generally be carried along hill sides, and often in situations which are completely exposed to the vicissitudes of the weather, (very great in such a climate,) and liable above all to great and sudden inundations of rain from the mountains, such as would carry bodily away the whole fabric of a road not especially constructed with a view to such occurrences. Very great attention was required in marking out the line, on which so much more than usual depended, that Telford uniformly attended personally to that business, until he became perfectly convinced that his official subordinates were adequate to so critical a task. It may afford some idea of the ordinary mode of construction, and of the works required in such situations, to give some details of the Spey-side Road where somewhat about the average amount of difficulties had to be overcome. This road was in length twelve miles and a quarter, in which distance the arrangements for carrying off the water required no less than seventy cross drains of two feet square, while of larger dimensions there were nine arches of

eet span, one of four feet, two of
, and two of eight feet, one of ten
ie of sixteen feet, one of twenty
ro of thirty feet, and one of thirty-
t; the large rivers Spey and Avon
also crossed in the course of the
[t will be seen from this that the
on for water courses was necessarily
the most important items of ex-
including this the total cost of the
de Road amounted to 6,734*l.* 10*s.*,
it 530*l.* per mile, which was rather
he average, partly in consequence
xtra width, twenty feet; the usual
a road of the common width of
feet, reached only 450*l.* per mile.
Highland roads require constant
n to preserve them from destruc-
ot so much owing to the effects
, as to the storms and frost to
hey are exposed. A staff of in-
s is constantly kept up, consisting
neral inspector and six superin-
s, each of whom is required to
ver the state of 200 miles of road.
nen are selected from among the
g masons, and encouraged to be
tly travelling by a mileage allow-
r expenses, a check being kept
hem by the imposed necessity of
regular journals of all their
ents. So strong is the effect of
icious allowance, that one of the
tendents, Robert Garron, whose
is Argyleshire, has actually tra-
no less than five thousand miles
gle year, and this, too, entirely
generally in the roughest weather,
ie greatest attention is always re-
lest a trifling damage left unre-
hould by the next "spate" be-
great as to stop the road inevi-
ntil the ensuing summer. The
tendents of late years have been
20*l.* per annum for the keep of a
as greatly to lessen their fatigues,
ne outlay of a few pounds a year
rnment in providing them with
roof clothing has greatly added
efficiency by averting the diseases
vere common in the earlier parts
career, from their unprotected
e to the frosts, snows, and rains
most rigorous climate in Great

original military roads are now
l in the same system of repair.
ere under the control of the War
ill 1770, and afterwards under a separate establishment, consisting of an inspector, sub-inspector, sixteen overseers, and (in summer) 270 labourers. In the year 1798, Sir Ralph Abercromby reported that these roads were no longer required for military purposes, in consequence of which, all those in the low countries were either entirely abandoned, or transformed into regular turnpike roads, so that, by the year 1824, the total length had been reduced from eight hundred miles, to only five hundred and thirty. At this time they were placed under the Highland Road Commission, who have greatly reduced the expenses of repair, and curtailed their length to no more than two hundred and eighty miles—all that is now remaining (except in deathless song) of the master-piece of General Wade.

The expenses of constructing the Highland roads were defrayed, in equal proportions, by the public and the landowners whose property was benefitted. Altogether the sums expended in roads, bridges, and harbours, (which were under the same control) amounted to considerably more than a million. In 1823 the account stood as follows:—

Roads and bridges..........	£450,000
Glasgow road..............	50,000
Harbours, &c..............	100,000
Expended by Government ..	£600,000
Local contributions	550,000
Total..............	£1,150,000

And after this an additional sum of 35,000*l.* was required to complete the works; not to mention a similar sum unwillingly contributed by contractors, whose eagerness or inexperience had led them, in the heat of competition, to name too low a price for the works they undertook, and whose claims to compensation were rejected by the Commissioners, solely on the ground, that, though not unreasonable, they were too extensive to allow them to hold out any hope of relief. It will be seen that the share borne by the public exceeded that which fell on the shoulders of the landowners. The reason of this inequality was, that the expenses of "management" were, by agreement, borne exclusively by the public; these were very great, the legal expenses of enforcing unfortunate contracts forming a principal

item; while the engineering charges during the whole period amounted to the not inconsiderable sum of thirty thousand pounds. Whether or not a hard bargain were driven on this occasion with the representatives of the public by the landowners, must be left for further consideration. It is highly probable no doubt, that had no assistance been afforded by Government, the roads would still be *in posse* only, but it is by no means so certain that it would have been impossible to effect the purpose by means of *advances*, to be repaid by degrees in case a certain improvement in the value of the adjoining lands should take place. At present, all the landowners near the line appear to be reaping the advantage of an immense increase in the value of their property, while the better half of the expense has been saddled on the backs of the community at large, without a stipulation for any return. With all this, however, Telford, at least as an engineer, had nothing to do, and with regard to his merits in the engineering department, there cannot be two opinions. It is understood that he himself always regarded his works in the Highlands with peculiar complacency, and that he was inclined to stake his reputation with posterity more upon these Scottish lines of road than upon any of the more striking efforts of his genius in England or Wales.

The numerous bridges over the principal streams intercepting the various lines of communication, which superseded in most instances the wide and dangerous ferries previously existing, gave occasion for a great display of skill in a line where Telford always found himself at home. The chief of these bridges were—one at Dunkeld, a sort of central point of a Highlands, where a most elegant structure was placed, the greater part of the expense, 30,000*l.*, being borne by the Duke of Athol, the proprietor of most of the adjacent country; one at Bonar, over the Dornoch Frith, composed of a bold iron arch of 150 feet span, and two stone arches of 50 and 60 feet span respectively; and another at Craig Ellachie, over the Spey, at a point where the rapid river cleaves for itself a passage through the solid rock; here a light and beautiful iron arch, harmonizing most admirably with the fine scenery to which it forms an additional embellishment, crosses the river at one span of fifty yards, while two small arches of stone, required by the exigences of the road, are most judiciously kept out of sight, from the principal point of view. The picturesque bridge last mentioned affords another instance of the possibility of blending the highest utility with the highest beauty,—though it may require the powers of a poet and engineer combined, like Telford, to effect the mystic union. At Potarch, on the Dee, another remarkable bridge was erected, advantage being at once taken of the narrowness of the river at that spot, and of the circumstance that a singular rock of porphyry in the middle of its bed presented both a fine object and an excellent abutment for the principal arch.

The effect of the establishment of the Highland roads and bridges has been greater than could have been anticipated. Allusion has already been made to the immense improvements they have caused in the value of landed estates in their vicinity, an improvement so great that in some instances farms will now produce an annual rent nearly equal to their value in fee-simple at the latter end of the last century. The increased facility of communication has also produced not less remarkable effects in other particulars. In conjunction with steam navigation, the parliamentary roads have so completely opened the Highlands to summer tourists, that every point which can boast of picturesque beauty is annually visited by shoals of travellers from all quarters of the globe, the "land of Cockayne" contributing a full share; while rugged heights, brawling torrents, and fearful mountain-passes, undreamt of out of the Highlands themselves half a century ago, are exposed to the gaze of the wearers of pink parasols, and transferred to their scrap-books (in "counterfeit presentment") with as much ease and contentment of body and mind as, whilome Putney Bridge or Twickenham Meadows. Nor is this all: a great change has likewise been worked in the ideas, as to conveyance in particular, of those who are "native, and to the manner born."

Up to the end of the last century, wheel-carriages were unheard of in the Highlands. The first stage-coach that ever ran upon a road within their circle

was started in 1806; this was followed by another in 1811; at the time of Telford's death there were *seven* stage-coaches daily from Inverness. One of these was the mail to Thurso, whose running completed an unbroken line of eight hundred miles, from London to the neighbourhood of John o'Groat's. This vehicle was first set on foot in 1819, by enterprising coach-masters, who however, would not undertake the task before the landowners had agreed to defray a part of the expence. This northern mail was a different concern in many respects from its brethren of the south: it was adapted for three inside passengers only, and three outside besides coachman and guard; was drawn by two horses, and timed only to six miles an hour—a pace which in severe weather it was found could not always be maintained, though the delays were seldom very great. After the lapse of a few years, however, although the assistance of the landowners has been withdrawn, the proprietors have been enabled to increase the speed throughout to eight miles an hour, and to put on four horses for the first fifty miles north of Inverness. A stage coach also now runs regularly from Inverary in Argyle to Oban on the west-coast; but wherever water conveyance is practicable, steam-boats go of course ahead of all competitors, and these, on both coasts, and on all the rivers and canals which are *steamable*, are now, in summer especially, well nigh past all counting.

Sir Walter Scott was wont to designate England "a land of post-chaises" in contradistinction to his own country: but this must surely be accounted a 'distinction without a difference,' when the very Highlands themselves are traversed in every direction by these leathern conveniences. At all the inns along the lines of road, and these, by the way, are now numerous and excellent, 'neat post-chaises' are regularly kept;—Inverness could always boast of one or two,—these are of course greatly increased in number, while the towns of Dingwall, Tain, and Inverary, can now boast of the attractive novelty. Private wheeled vehicles have meanwhile increasend in as great a ratio, in proof of whicdh, and consequently in proof of the complete success of the Highland road system, both *as to construction* and repair, the races at Inverness are now commonly attended by no less than *a hundred and sixty carriages*, and two-wheeled chaises. In every point of view, in fact, the formation of these Parliamentary roads marks a new era in the progress both of commerce and civilization in the north.

PRACTICAL DEFICIENCIES OF SCIENTIFIC WORKS.

(From the "Adventures of the Missionary Williams."*)

After some deliberation I determined to attempt to build a vessel; and, although I knew little of ship-building, and had scarcely any tools to work with, I succeeded, in about three months, in completing a vessel between 70 and 80 tons burden, with no other assistance than that which the natives could render, who were wholly unacquainted with any mechanical art. I thought at first of getting the keel only at Rarotonga, and completing the vessel at Raiatea, but, as the king, chiefs, and people urged me to build it at their island, promising me at the same time every assistance in their power, I yielded to their wishes. As many friends have expressed a desire to know the means by which this great work was effected, I shall be rather more minute in detailing them than I should otherwise have been.

My first step was to make a pair of smith's bellows; for it is well known that little can be done towards the building of a ship without a forge. We had but four goats upon the island, and one of these was giving a little milk, which was too valuable to be dispensed with; so that three only were killed, and with their skins, as a substitute for leather, I succeeded, after three or four days labour, in making a pair of smith's bellows. These, however, did not answer very well; indeed, I found bellows-making to be a more difficult task than I had imagined, for I could not get the upper box to fill properly; in addition to which my bellows drew in the fire. I examined publications upon mechanic arts, dictionaries, and encyclopædias, but not one book in our possession gave directions sufficiently explicit for the construction of so common an article; and it appears to me a general deficiency in all the works I have seen on the useful arts, that they do not supply

* The Bishop of Chester, alluding to the splendid folios of theology and religious adventure and instruction, with which his library was stored, said at a public meeting, "He knew not whether he would not put away at least half the folios he possessed, rather than part with one volume which had recently been published by the missionary Williams."—Mirror.

simple instructions and explanations as l direct to the accomplishment of an tant and useful object by means less lex than the machinery of civilized ries. When, for example, we were us to make sugar, and, for this pur- carefully read the article on sugar- g, in the most popular Encyclopædia r possession—not having the apparatus in described—we derived no practical it from it. If, in addition to a thorough cientific description of the most perfect ods, there were appended plain and e directions for manufacturing the without the expensive machinery in ion use, it would certainly be of im- e service to persons situated as we, and ants to new colonies have been. These ks are applicable to soap-boiling, salt- ng, paper-manufacturing, and a variety ier processes of a similar nature.

ssionaries, and others leaving the ry, when in search of information upon as important subjects, generally fail in object, by seeking it where every thing ected by complex machinery, and all mprovements of the present age are l in perfection. It was so with us. We taken to places of the above descrip- -we gazed, we wondered, and were de- d, but obtained no practical informa- for few imagine that there is any other of effecting an object than that which see. All persons going to uncivilized ries, especially missionaries, should that knowledge which may be easily ed, as they have to do every thing selves, and in situations where they ot obtain the means in general use else- . It may, by some, be thought un- to go back a hundred years, and em- the tedious processes then in use, rather embrace the facilities which the expe- of succeeding ages has afforded. But an opinion, although specious, is un- l. Let the circumstances of the mis- ry, and the state of the people to whom es, be taken into the account, and it be at once obvious, that the simplicity e means used two or three hundred ago, would better suit both his con- and theirs than the more complex im- ments of modern times.

LURTON ON STEAM PLOUGHING.*

e prize of 500*l*. continued to be offered ne Highland Society of Scotland (see s and Notices, p. 576), for the first ssful application of steam power to ploughing, is well calculated to keep expectations of success alive, and to induce ingenious men to apply themselves with earnestness to the solution of the problem. The only plan which can be said to have as yet had a fair trial is that of Mr. Heathcote, in which the engine is stationary and the plough is moved forward by means of an endless chain, and this is generally understood to have proved, after a very large expenditure of money, an entire failure. Mr. Blurton, who describes himself as a "tenant farmer," and is well known to all dairy farmers as the inventor of the Swing Cheese Press, Milking Pan, Syphon Can, &c., has endeavoured in the Essay before us to give a new direction to the inventive efforts of those who may happen to have turned their minds to the subject. Mr. B. does not affect to bring to their aid any science or ingenuity of his own, but contents himself with stating what his practical knowledge of farming leads him to regard as the conditions necessary to success, and with bringing together from various authentic sources a number of ascertained facts which, in his judgment make success very surely attainable—all which he has done in a most plain and unpretending, but not on that account less convincing style. "To make a locomotive steam-engine," says Mr. Blurton, "practically and generally useful for agricultural purposes, the carriage on which it rests must be so constructed that it may be taken to the field as conveniently as a common cart, and the farmer should have but little or no more difficulty in the preparation for ploughing than is now necessary on the old system." Neither, we beg to add, should he have any more difficulty than he now has in using the steam plough, after he has got it into the field, than in bringing it there. Mr. B.'s idea of the means by which these desiderata may be realized is briefly unfolded in the following paragraph:—

"The difficulty of turning a locomotive engine on a carriage with four wheels, at each extremity of the furrow, must be obvious to every practical farmer. But it appears evident that if a plan be adopted of fixing a locomotive steam engine on a two-wheeled carriage, with double shafts for a pair of horses, to which carriage the plough or ploughs may readily be attached, the difficulties of turning on the headlands will be obviated; besides which, the expenses of the carriage will be lessened, the friction considerably decreased, the machinery be less complicated, and the whole more easily directed by a pair of horses than by the hands of an engineer, however expert he may be."

From "the facts" which Mr. Blurton has

* *Essay on Steam Ploughing*. By William . 16 pp. 12mo. Birmingham: Allen and 840.

collected to show the practicability of such "a plan," we select a few of the more striking:

"Mr. Gurney's engine was brought from London to Cyfaithfa Iron Works in South Wales, by a pair of horses, on the wheels used in its usual occupation of travelling; therefore the wheels may either turn round the axle like a common cart, or either wheel may be attached to the axle by a bolt or clamp; or, on the more simple plan adopted by Dr. Church, in his steam carriage used on turnpike roads, where both wheels are connected with the axle in such a manner as to admit of turning in either direction without disconnecting the parts.

* * * * * *

"Mr. Gurney's ordinary travelling carriage is twelve nominal steam-engine horse power, and he states that by successive improvements, the *weight* of his carriage, without losing any of its propelling power, may be reduced to 35 cwt., exclusive of the water and coke, but thinks it is possible to reduce the weight still further.

* * * * * *

"The stages, says Mr. Gurney, into which the journeys are most conveniently divided, are about seven miles; and it takes on an average about 315 lbs. of coke, and 700 lbs. or 70 gallons of water to supply that distance. Now the greatest length of the ploughed lands on the farm which I hold is 220 yards, which, from end to end of each furrow and back again, familiarly called "*a bout*," is 440 yards, or $\frac{1}{28}$th part of the seven mile stages of Mr. Gurney's steam-carriage. It therefore appears plain to me, that the quantity of water and coke sufficient for the longest ploughing stages, viz., 440 yards, might be easily supplied during the time of turning at the end of every bout, (consequently, a tender holding two or three gallons of water would be sufficient.

"It is, therefore, *at least probable*, that the capacity of the boiler, and quantity of water and coke, and consequently the comparative weight of the whole engine might yet be considerably reduced, provided that a sufficient power of steam can be generated by a less capacious boiler, and a less quantity of water. * * * * * * *

"It was stated amongst other details, in the House of Commons in 1831, respecting steam carriages, that a horse is able to draw from 20 to 40 cwt. on common roads. I have frequently met one-horse carts, loaded with ground flint or stone, which I was informed weighed from 20 to 30 cwt. each, exclusive of the weight of the cart, and generally drawn by one horse only, along the *most haggy* and *worst* turnpike roads that I ever saw. Therefore I feel confident that a pair of horses in shafts abreast, would be capable of moving the plough-drag and engine, at all proper seasons for ploughing, at the rate of two and a half miles an hour."

Now for the argument:

"Presuming, therefore, that the weight of the carriage and engine will be overcome by the pair of horses, the problem of ploughing by the assistance of steam power, to my apprehension, becomes plain and demonstrable. For the practically available force or power of a steam-engine, as before described, being 1050 lbs., moving at the rate of two and a half miles an hour, and the greatest draught of the plough, also presuming that it moved at the same rate, as tested by Mr. Handley, being 347 lbs. By dividing the former by the latter, we have the draught of three single ploughs and 9 lbs. to spare, in the practical power of the steam-engine alone: or if it be supposed that the pair of horses wanted assistance to draw the load, and it might be advisable to use a double or two single ploughs only, instead of three, we then have (on the principle of the same calculation, viz. by doubling the draught of a single plough, which would be 694, to draw the double or two single ploughs,) an excess or extra power of 356 lbs., to assist the horses, if necessary and this extra power would, it is conceived, be more than equivalent to counterbalance any increase of draught that might arise from the difference of soils or other apparent causes.

"One double or two single ploughs, moving in a straight line, at the rate of two and a half miles an hour, and ploughing furrows ten inches wide each, would plough an acre in about two hours: consequently, four acres might be ploughed in eight hours: but allowing the loss of an acre in four, for the time taken in turning at each end of the furrows, three acres only would be completed in that time by one pair of horses aided by steam.

"A farmer, however, would do well, on long summer days, to work his four horses alternately in pairs; when on the foregoing calculation, six acres would be accomplished in a day, by two pair of horses working eight hours alternately. I have several fields of stiff marly clay, on which it is considered hard work for four horses to plough an acre per day, or twelve acres in twelve days: but, upon the plan of combining the two powers, the same number of horses would finish it in two days, or perhaps in less time."

Mr. B. enforces these views by many more equally forcible observations for which, however, we must beg leave to refer to the

Essay itself—a course to which we are the more disposed, seeing that by the new Postage System under which we have the happiness to live, any of our readers may, by sending a shilling under cover to Mr. Blurton (Field Hall, near Uttoxeter) obtain, as we have done, a copy of the Essay by return of post.

MR. CHARLES HANCOCK'S NEW PROCESS OF COLOURED PICTURE-PRINTING.

We have been much gratified by the inspection of a proof-print of a picture painted, engraved, *and printed in colours*, by a new process (so as to present a perfect *fac simile* of the original), by Mr. Charles Hancock, the eminent animal painter. The subject is deer-stalking in the Highlands. A huntsman in tartan costume is about to let slip two magnificent-looking stag-hounds, in pursuit of a herd of deer, seen scampering off in the distance, along the base of a range of precipitous cliffs, just lit up by the rays of the morning sun. A subject better calculated to show off the merits of the new process—from the great variety of bright colouring which it embraces—could scarcely have been selected; and in point of execution it does in every respect great credit to the talents of the artist. The change from colour to colour, and the gradations of tint in each colour, are effected with as nice a resemblance to nature as if they had been done, not by a machine, but with infinite skill by the hand and brush. Indeed no person could, from mere inspection, discover any difference.

The process by which this important result has been obtained, and for which Mr. Hancock has procured letters patent, we shall now very briefly describe.

An outline is first etched and transferred to as many plates as there are positive colours in the picture, and any required gradations of light and shade in each colour, are produced upon the plate assigned to that colour, which is done by any of the ordinary modes of engraving. The different plates are then printed from in succession, with the colours appropriate to each, the *chief care* required being that of *adjustment, so that one impression shall not, in the slightest degree overlay another.*

To the publishers of prints this process is of great and manifest advantage. Two or three engravers can by means of it, work simultaneously from the same picture, and a greater number of copies can be produced in a given time than has ever hitherto been done by any other process—much better copies too, inasmuch as prints coloured after nature are superior to prints in the ordinary black and white (supposing both to be equally well printed). The cost of each series of plates is not more than that of one plate engraved in the usual way (the metal only excepted), while against the extra expense of working there is to be set the entire saving of the print-colourer's bill, for daubing in the wretched flare-up style which the shop-windows have made familiar to the public.

This process will probably be found equally valuable to some of our manufactures—in the ornamenting of China for example, paper-hangings, cottons, silks, and other useful and ornamental fabrics; particularly as the process can be applied to surfaces engraved in relief and printed at a type-press, as well as to the ordinary modes of copper-plate engraving and printing.

REPORT OF COMMITTEE ON MR. HARRIS'S LIGHTNING CONDUCTORS.

(See page 497.)

Selection from Appendix of Documents.

1. Experiments to test the efficacy of Mr. Harris's Conductors by means of a discharge of artificial electricity.

Extract from a Letter from Admiral Sir T. Byam Martin *to Rear Admiral* Griffiths; 12*th June*, 1839.

* * * *

At an early period after Mr. Harris had submitted his plan, I took the opportunity of an official visit to Plymouth Dockyard, to invite him to a practical exhibition of it.

For this purpose, a dockyard vessel, of about 100 tons' burthen, was taken into dock and fitted under Mr. Harris's directions; the work necessary to be done being to drive copper bolts through the keel at the aft part of the step of the mast, so as to bring the conductor in direct contact with the bolts. The conductor is a thick piece of copper passing from a spindle in the truck, in a groove down the aft part of the mast, in one continuous line to the bolts through the keel.

The vessel thus prepared was anchored at

a distance of about 30 yards from the stern windows of the *Caledonia*, having a copper wire leading from the electric battery in the cabin of that ship to the mast-head of the vessel.

At a few yards from the vessel, but unconnected with her, a boat was anchored, in which was placed a loaded gun.

From the touch-hole of the gun a copper wire passed over the side of the boat into, and just below the surface of the water, in order to catch the electric matter discharged from the battery in the *Caledonia's* cabin; it being intended to demonstrate, by the firing of the gun, that the electric matter had passed down the conductor on the vessel's mast, and through her bottom.

Nothing could be more perfect than the success of the experiment; the gun was fired, to the astonishment and satisfaction of the numerous spectators.

I thought it my duty on this occasion to give publicity to the intended experiment, that persons of all classes and descriptions might witness it.

There were present, Commander-in-chief Sir Alexander Cochrane, and, I believe, all the captains of the ships in the port, also many military officers of the several corps, and gentlemen of the neighbourhood.

There appeared to be but one feeling of approbation, and of confidence in so clear an illustration of the effectual protection that might be given to ships by the adoption of Mr. Harris's plan.

A similar experiment was made from the upper windows of Somerset-house, to a vessel moored in the river, with a gun in a boat beyond her.

There were present several members of the Royal Society; and of the number, that highly-gifted, scientific, and distinguished man, the late Dr. Wollaston.

Dr. Wollaston, ever cautious and guarded in the promulgation of his opinion upon any doubtful point, spoke to me on this occasion in terms of general approbation. At first, he was inclined to think it might be better to lead the conductor from the mast along the beam, and so out of the scupper-hole in the ship's side; but, upon further consideration, he abandoned that idea, and gave a decided preference to the perpendicular line suggested by Mr. Harris.

A misconception with respect to Dr. Wollaston's opinion having got abroad, which was so entirely at variance with what he said to me, that I immediately wrote to ask if I had correctly understood him; and the following is a copy of his answer, dated in April, 1823, which I now transcribe from my letter-book:—

"In reply to the inquiry, whether I see any danger, insecurity, or liability to objection in the method proposed by Mr. Harris, of carrying off lightning from ships by fixed conductors, I certainly ought most unequivocally (as far as my opinion may go) to express general approbation of his proposal.

"Mr. Harris appears to me to be well acquainted with the subject, and fairly to estimate the powers of the element with which we have to contend, and the means of directing it with as little injury as may be to surrounding objects."

I state these experimental proceedings without venturing to make any comment upon them, leaving it with you to estimate their value. It would indeed be presumptuous in me to attempt to say a word after such an opinion from such a man as Dr. Wollaston. * * * * *

Letter from Admiral Sir M. Dixon, *Commander-in-Chief at Plymouth, to the Secretary of the Admiralty; dated* 11*th October*, 1830.

Sir—In compliance with the orders of the Lords Commissioners of the Admiralty, to transmit a detailed account of the experiment on board the Caledonia on Mr. Harris's lightning conductors, I have to acquaint you that I immediately applied to Mr. Harris for a detailed sketch of his own proceedings, both previous and at the instant of time the experiment was effected. Mr. Harris observes, that "in subjecting the lightning conductors fixed in the masts of his Majesty's ship Caledonia to a discharge of artificial electricity, it appears to have been Mr. Harris's intention to afford some illustration of the action and efficiency of these conductors in thunder-storms, in transmitting an electrical discharge directly through the keel or other parts of the ship into the sea, as also to prove by experiment their complete continuity and perfect application.

"To this effect a cutter was moored abreast of the ship, at about 80 fathoms distant, and midway between the ship and the cutter a boat with a gun in it. For the purpose of transmitting the accumulated electricity, a conducting line was led from a given point of the electrical apparatus in the cabin of the cutter through the skylight into a large hemispherical cup, fixed over the extremity or termination of the conductor at the truck, on the main royal-mast-head of the ship. This cup was filled with gunpowder, a small quantity of more explosive powder being previously placed in it, immediately under the termination of the conducting line just mentioned.

"A second conducting line communicated from the negative side of the battery

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II TABLE.—*Showing a proposed Scale of Dimensions for Lightning Conductors, approved by Mr. Snow Harris before the Commission of Inquiry!*
also the Relations of Capacity of Rods and Plates of various Dimensions. By Mr. W. M. Rice of H. M. Dock-yard, Chatham.

cutter in a similar way, with a cup of r dimensions, prepared as before, and ed to the tube of powder in the touch- f the carronade in the boat, and from with the sea, by means of a small ver the side of the boat.

powerful charge of artificial elec- being now accumulated by means e electrical battery in the cabin of utter, the explosion was transmit- the cup on the truck at the mast-head, where, breaking into a centrated spark, it fell through the wder upon the extremity of the con- s inserted in the mast, and fired it; same instant of time the electrical passed down the conductors in the , and through the keel into the sea, its course to the negative side of the y through the water, fell upon the cting line connected with the gun in at, and discharged it. The shock was nsible in the ship to persons in contact he conductors on the mast, and so taneous appeared to be the effect, o sensible interval of time elapsed en the discharge of the gun and the ion of the powder on the truck.

Mr. Harris considers that a discharge tural electricity would, in case of its on the ship, be got clear of in a r way, the conductors fixed in the onia being equivalent to those of St. Cathedral in London.

This experiment is further considered r. Harris to represent justly the ope- of the conductors in thunder-storms, as the ship is concerned; the dis- e being then supposed to take place ly between the cloud and the sea gh the ship, instead of passing over the ial circuit or line abovementioned. In se of the natural discharge, therefore, ction ceases when the lightning has ed the sea. The explosion of the gunpwder truck, and the simultaneous discharge gun effected by the artificial arrange- is consequently resorted to merely to that the electrical discharge has fallen e conductors, and has been transmitted of the ship into the water, which was shown."

I am, &c.

igned) Manley Dixon, Admiral.

r from Admiral Sir M. Dixon *to the retary of the Admiralty; dated* 19*th tober*, 1839.

—In obedience to the directions of my Commissioners of the Admiralty to have Mr. Harris's experiment of the light- ning conductors repeated on board the Cale- donia, with the topgallant-masts and top- masts struck, severally, and to state my opinion as to the efficacy of the process in such circumstances,

I herewith transmit, for the information of their lordships, the subjoined statement of the proceedings of yesterday; and that I find the experiment fully equal to the first trial made and the efficacy of the process the same as in the former trial with the top- gallant-mast fidded.

"The electrical arrangement did not differ from the preceding, detailed in the report of the experiments on the 11th instant.

"But in this instance the explosion was transmitted when the topmast and topgal- lant-mast were partially struck, the topmast being lowered down about 30 feet, and the topgallant-mast as far as possible.

"The electrical battery employed amounted to 15 square feet of coated glass, which was highly charged. When the communication was made between the points of action in the cabin of the cutter, *id est*, between the posi- tive and negative side of the battery, the ac- cumulated electricity passed with incon- ceivable rapidity through the ship as before, inflaming in its course the gunpowder on the truck, and discharging the carronade at the same instant of time."

Mr. Harris conceives that the part of the experiment which relates to the rapid trans- mission of the electrical agency through the water is highly favourable in showing the efficiency of the operation of the conductors. Since in the case of the natural action the surrounding ocean would abstract the elec- tricity from the termination of the conductor as rapidly as the charge falls on it from above, and disperse it, thus an unimpeded action would be perpetually maintained. Such he thinks must be always the case with ships, but imagines that the absence of the same free diffusive means, may be the cause of failure in metallic conductors ap- plied to buildings on shore, for unless this dispersive power exist in the point in which the conductor terminates, the transmitting action of the metal becomes impeded, and it is no longer an adequate protection.

The position of the masts does not seem to be of any consequence to the success of this experiment. In all positions a con- tinuous line seems to be effectually preserved between the highest points and the sea.

I am, &c.

(Signed) Manley Dixon, Admiral.

II TABLE.—*Showing a proposed Scale of Dimensions for Lightning Conductors, approved by Mr. Snow Harris before the Commission of Inquiry; also the Relations of Capacity of Rods and Plates of various Dimensions. By Mr. W. M. Rice of H. M. Dock-yard, Chatham.*

DESCRIPTION OF MASTS, &c.	Proposed Scale for Mr. Harris's Conductors.	Area of Section of proposed Conductors.	Area of Section of a Copper Rod of $\frac{1}{8}$ Inch Diameter.	Ratio of proposed Conductor to a Copper Rod of $\frac{1}{8}$ Inch Diameter.	Area of Section of a Copper Rod of $\frac{1}{4}$ Inch Diameter	Ratio of proposed Conductor to a Copper Rod of $\frac{1}{4}$ Inch Diameter.	Diameter of a Copper Rod equivalent in Area to proposed Conductor.	Diameter of an Iron Rod of equivalent Conducting Capacity to proposed Conductor.	Area of Section of a Copper Rod of $\frac{1}{2}$ Inch Diameter.	Ratio of proposed Conductor to a Copper Rod of $\frac{1}{2}$ Inch Diameter.
	In Lamina of $\frac{1}{8}$ and $\frac{1}{16}$.	*Square-inch.*	*Square-inch.*		*Square-inch.*		*Inches.*	*Inches.*	*Square-inch.*	
Lower masts	$4 \times \frac{3}{16}$ inches	.7500	.01225	61.12:1	.049	15.28:1	.997	1.954	.1963	3.82:1
Topmasts & jib-boom	$3 \times \frac{3}{16}$ inches	.5625	.01225	45.76:1	.049	11.44:1	.846	1.692	.1963	2.86:1
Topgallant-masts and flying jib-boom.	$2\frac{1}{2} \times \frac{3}{16}$ inches	.4688	.01225	38.08:1	.049	9.52:1	.772	1.544	.1963	2.38:1
To taper from hounds to truck, from $2\frac{1}{2}$ in. to $1\frac{1}{2}$ inches, mean.	$2 \times \frac{3}{16}$ inches	.3750	.01225	30.56:1	.049	7.64:1	.692	1.380	.1963	1.91:1
Least section of the proposed conductors.	$1\frac{1}{2} \times \frac{3}{16}$ inches	.2812	.01225	22.88:1	.049	5.72:1	.598	1.196	.1963	1.43:1
Mean Areas and Ratios ..		.4875	.01225	39.68	.049	9.90:1	.790	1.580	.1963	2.48:1

Note.—A copper rod of half an inch diameter is considered adequate to transmit any discharge of lightning hitherto experienced, without being fused or destroyed. The above Table gives the ratio of the electric capacity of the proposed conductors to copper rods of one-eighth, one-fourth, and one-half inch diameter upon the lower masts, to be respectively as 61.12, 15.28, and 3.82:1; and at the least section of the proposed conductor to the same rods respectively as 22.88, 5.72, and 1.43:1. If the rods be of iron, the ratios in favour of the proposed conductor will be increased fourfold; and the diameter of an iron rod of equivalent conductng capacity to the proposed conductor, compared with the greatest section, will be as 1.95:1, and with the least section as 1.196:1. Hence we may infer that there will be no liability of danger from too near an approximation to the acknowledged standard of safe action, viz., the half-inch copper rod, by the adoption of the above reduced scale of dimensions for Mr. Harris's conductors.

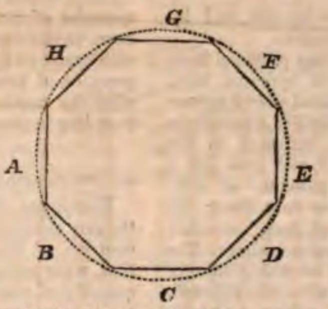
(Signed) W. M. RICE,
Her Majesty's Dock-yard, Chatham.

London, 12th June, 1839.

III TABLE (by Mr. Rice.)—*Showing the Deflections due to the following Weights, suspended at the middle of a Jib-Boom, upon every "Eight Square" successively, with and without Harris's Lightning Conductors attached.*

Sides uppermost.	Weights placed in the Scale.	Deflection of Spar by its own weight.	Cwt. $\frac{1}{4}$	Cwt. $\frac{1}{2}$	Cwt. $\frac{3}{4}$	Cwt. 1	Cwt. $1\frac{1}{2}$	Cwt. 2	Cwt. $2\frac{1}{2}$	Cwt. 3	Cwt. 4	Cwt. 5
A	Without the conductor..	0.9	0.18	0.35	0.5	0.7	1.05	1.4	1.7	2.1	2.8	3.45
	With the conductor....	0.7	0.15	0.34	0.5	0.68	1.01	1.35	1.68	2.03	2.7	3.42
B	Without the conductor..	0.9	0.15	0.33	0.5	0.68	1.01	1.38	1.75	2.08	2.8	3.40
	With the conductor....	0.45	0.15	0.30	0.46	0.61	0.91	1.22	1.54	1.86	2.52	3.2
C	Without the conductor..	1.4	0.19	0.35	0.52	0.7	1.05	1.4	1.75	2.1	2.8	3.45
	With the conductor....	.97	0.15	0.29	0.42	0.58	0.86	1.15	1.44	1.73	2.4	3.0
D	Without the conductor..	1.5	0.19	0.35	0.54	0.71	1.08	1.42	1.8	2.15	2.9	3.5
	With the conductor....	1.15	0.16	0.31	0.48	0.63	0.95	1.28	1.6	1.94	2.65	3.25
E	Without the conductor..	1.6	0.19	0.38	0.54	0.7	1.08	1.42	1.78	2.15	2.85	3.48
	With the conductor....	1.5	0.17	0.32	0.47	0.66	1.0	1.35	1.68	2.02	2.7	3.46
F	Without the conductor..	1.6	0.15	0.32	0.5	0.68	1.01	1.37	1.72	2.06	2.77	3.42
	With the conductor....	2.0	0.15	0.31	0.45	0.6	0.92	1.23	1.55	1.88	2.51	3.23
side G coppered.	Without the conductor..	1.2	0.15	0.32	0.5	0.66	1.01	1.37	1.7	2.05	2.78	3.4
	With the conductor....	1.1	0.14	0.28	0.41	0.54	0.85	1.11	1.4	1.69	2.28	2.81
H	Without the conductor..	0.9	0.15	0.33	0.51	0.7	1.05	1.41	1.77	2.12	2.83	3.5
	With the conductor....	1.0	0.15	0.31	0.48	0.63	0.95	1.28	1.6	1.92	2.68	3.1

REMARKS.—Length of spar between the props, 34 feet; middle diameter, 7 inches; end diameter, 5 inches. A, B, C, D, &c. represent the eight sides of the spar, upon which the flexure was produced. The conductor is supposed to be inserted on the side G. The flexure is estimated in inches, from the middle of the spar.



The conductor played freely with the bending of the spar, without being in the least disturbed.

By this Table it appears, first, that the spar was actually strengthened by the application of the conductor in every position; second, that the greatest strength was evinced when the conductor was on the upper, or concave side, as at G; next, when on the lower, or convex side, as at C; least, when on the edges as at A and E, where the copper stood vertically; and intermediate on the oblique sides, as at D, F, H, B.

The weights requisite to be added to the 5 cwt. in order to bring the index to the same point with the conductor as without it, were as follows:—

Sides uppermost	A	B	C	D	E	F	G	H
Weight in lbs...............	7	58	63	35	5	35	98	66

When, therefore, the side G, in which the conductor was inserted, became compressed, the resistance to the given point of flexure was increased by nearly one-sixth. The respective weights, with and without the conductors, being $(500+98)=598$ lbs. and 500 lbs. to bring it to a deflection of 3.5 inches in both cases. The above results were tabulated from my own observations. The experiments were conducted by Mr. Snow Harris, at Portsmouth Dockyard, in the early part of the year 1831.

CERTAIN ANTIDOTE TO ARSENIC.

The efficacy of the hydrated peroxide of iron in counteracting the fatal effects of poisoning by arsenic has already been made public; but a sufficient number of facts had not seen furnished so as to leave no doubt upon the certainty of its action as a specific against arsenical preparations; but the following seven cases remove all incredulity upon this important acquisition conferred by the progress of chymical science, and which for the sake of humanity cannot be made too public, as it is now incontestably proved that the peroxide of hydrated iron is the most certain, safe, and ready antidote against arsenic known.

On the 9th of October last Dr. Puchelt, of Berlin, was called to attend Charlotte Lenz, aged 35, who had been taken suddenly ill after her dinner. He found the patient of a deathlike paleness, her features contracted. She had trembling fits, her pulse was small, frequent, and almost imperceptible to the touch. She suffered also from constant vomitings, accompanied by violent spasms in the region of the stomach. The *abdomen was contracted*, and little affected by pressure; the tongue pale, but slightly coated.

The patient stated that she had dined at the house of a neighbour, named Bauer, and with three of his children; she had herself cooked the dinner, as the man's wife was not at home. In a quarter of an hour after partaking of some soup, she became so ill that they were obliged to carry her home. Dr. Puchelt repaired to the house where she dined, and found the three children and the father extended on beds, and apparently in the agony of death. One of the children was 15 months old, the second 3½ years, and the third 5 years. They were all seized with illness shortly after partaking of a few spoonfuls of the soup. The father who took two soup-plates full, and some meat, went to work after dinner, but was obliged to return immediately, in consequence of the violent pains and spasms with which he was seized. He as well as the children exhibited the same symptoms as the female above alluded to. After some inquiries the medical attendant ascertained that Charlotte Lenz had taken, in mistake for flour, a spoonful

of arsenic kept for destroying rats, and incautiously left in the cupboard.

Dr. Puchelt had fortunately provided himself with some peroxide of hydrated iron, and immediately administered a large spoonful to the father, and a smaller quantity to the children. He then returned to the lodgings of Charlotte Lenz, and gave her a similar portion of the peroxide of iron. Five minutes after the first dose Bauer, the father, vomited; the second dose (spoonful) was then given, and he became calmer. The children also vomited, but on taking more of the peroxide of iron, they were soon relieved, and the two youngest fell asleep. At half-an-hour after the first dose an aperient effect was produced upon the father, and the symptoms were considerably diminished, the uneasiness and violent colics ceased, and the countenance assumed a natural appearance. The female Lenz was also relieved after the first few doses.

In the evening Bauer and the two youngest of the children were in a satisfactory state; but Charlotte Lenz, who had been previously ill, and the eldest daughter, who had taken very little of the antidote (having obstinately resisted), were not so much recovered as the others; another spoonful was accordingly administered to each. On the following morning Bauer was able to resume his work, and the two younger children had quite recovered. The eldest, however, was still paler and complained of uneasiness; the abdomen was swollen and tender, and the tongue coated, but what she particularly suffered from was a violent palpitation of the heart, which came on at intervals; this palpitation was easily heard by the stethoscope, but by no means in unison (synchronous) with the pulse, which continued small. A sinapism was applied to the region of the heart, and another dose of peroxide of iron administered, as also to the female Lenz, who exhibited the same symptoms. Aperient medicine was given in the evening, and with effect; next morning they were both much better, the palpitations had subsided, and the pulse became strong, the appetite returned, and in the course of a few days the cure was perfected.

On analyzing the portion of soup left, it was found to contain a quantity of white oxide of arsenic. The matter rejected from the stomach was also analyzed, and showed the presence of arsenic; in the portions mixed with the peroxide of iron (taken as the antidote) it was ascertained that the peroxide was changed into the arseniate of iron; that establishing its claims as a specific. Two other cases are detailed, in which two children, one eight years and the other ten years old, had swallowed half a spoonful of arsenic mixed by mistake in some vegetables; they were instantly seized with symptoms similar to the above. The peroxide of iron was administered six hours after the accident, and was attended with complete success.—*Medicenische Annalen.*

ON PROPORTIONS INVOLVING CONSTANTS.

Every one who knows any thing about the very simple but very beautiful and useful doctrine of Proportion is of course aware that, when any proposed result is a stipulated quantity of work to be done, the product of the time and power, each estimated in some known unit, expresses the value or quantity of the work; as, for example—a certain labour to be done requires the power of a certain number of men or horses, for a certain number of days or hours, and the product of these numbers expresses the value of the work in the number of days or hours of a single man, or horse, necessary for the performance of it. When the number expressing the power and that expressing the time are equal to each other, the effect is numerically the greatest possible. Thus, for instance, 12 men in 12 days do more work then 11 men in 13 days; these, again, more than 10 men in 14 days; these more than 9 men in 15; and so on; the effects for the numbers stated above being, respectively, 144, 143, 140, 135,—the difference being the series of the odd numbers 1, 3, 5, &c.

Hence, it is easy to understand that, if the effect is to be the same in two cases, and either the power or the time different, the time answering to any power, or the power answering to any time, may at once be found by dividing the product of the power and time, in the case where both are given, by the power or time which is given in the other case.

There is, however, one form under which this problem sometimes presents itself, which is a little puzzling to those who are not familiar with the doctrine of ratios; and as the management of it is a very easy matter, though, so far as we know, not mentioned in any of the elementary books, we may give a short explanation of it. This will be best done by putting a case:—A certain mine requires to be cleared of an influx of water, which is constant at all seasons of the year; it has been twice neglected, and allowed to fill; and in the first instance, a power of 8 horses cleared it in 12 hours; while in the second instance, a power of 9 horses cleared it in 10 hours. It is required to know what power will keep the mine dry, and what power is requisite for simply discharging the accumulated water which fills it, without any reference to the influx?

By the conditions, a power of 8 horses for 12 hours, and a power of 9 horses for 10 hours, both empty the mine of the accumulated water and influx. The product in the first case is 96, and that in the second case is 90, the difference of which is 6, that is, 6 hours work of 1 horse power. The difference of the times of emptying is 2 hours; and as 6 hours more work is required for these 2 hours, it follows that as much water flows into the mine in 2 hours as 6 horses for 1 hour can discharge; consequently, the power required to discharge in 1 hour the water which flows in 1 hour is that of 3 horses, or, in other words, a 3 horse power would keep the mine clear of water, on the supposition that none were accumulated.

Reviewing the steps of this analysis, we find that they involve this very simple rule; Multiply each power by its time; divide the difference of the products by the difference of the times; and the quotient will be the constant power requisite to perform the constant work.

To know the power which discharges the accumulation, subtract the constant power from each of the given powers, and the remainder in each case will be the power which discharges the accumulated quantity in the time specified in that case. Thus, in the instance which we have given, if 3 is subtracted from 8 and from 9, the remainders are 5 and 6; and as 5 answers to 12 hours in time, and 6 to 10 hours in time, and the product is in both cases 60, which shows that the powers, cleared of the constant 3, are true proportionals to their respective times; and that the pit, without taking the influx into account, can be cleared of water by 60 hours of 1 horse power, or in a single hour by a power of 60 horses, which in effect is just the same.—*The Surveyor, Engineer, and Architect.*

PATENT CASE.

Vice Chancellor's Court, April 22, 1840.

Application was made to the Vice Chancellor by Mr. Jacob, Q. C., for an injunction to restrain Mr. G. Beard, of Lambeth, from using cabs of the kind invented and patented by Messrs. Gillet and Chapman. The injunction was instantly granted.

[This is one of many similar applications which (with the like success) the patentees have been compelled to make in defence of their patent right, and we understand that more are in contemplation—and all this notwithstanding two verdicts already obtained in confirmation of the patent. Certainly this is a remarkable instance, but unfortunately not a singular one, of the inefficiency of the protection afforded in many cases by the patent laws in their present state. Ed. M. M.]

LIST OF DESIGNS REGISTERED BETWEEN 26TH MARCH, AND 23RD APRIL, 1840.

1840. Date of Registration.	Number on the Register.	Registered Proprietor's Name.	Subject of Design.	Time for which protection is granted.
Mar. 26	284	Townsend, Parker & Co.	Stained paper	1 year.
27	285	J. and F. Weiss	Rotary fountain	3
30	286	Geo. Dacre	Portable letter-balance	3
April 1	287	C. T. Cooke	Chimney top	3
7	288	T. Boulton, jun.	Steel for sharpening table knives	3
10	289	F. Harrison	Gambroon	1
"	290	Ditto	Ditto	1
12	291	The Carron Company	Scraper and pan	3
"	292	Coalbrookdale ditto	Laundry stove	3
13	293	J. Smeeton	Button	3
15	294	W. Man	Lock	3
20	295	S. Ackroyd	Stove	3
"	296	J. Newcomb and Son	Carpet	1
22	297	J. Osborne	A box for delivering of coals	3
23	298	J. Bretts	Quadrants & pointers for letter scales	3

LIST OF IRISH PATENTS GRANTED IN MARCH, 1840.

Charles Delbrick, for an improved method or methods of uniting or soldering metallic substancs.

James B. Nelson, for certain improved methods of coating iron under various circumstances to prevent oxidation or corrosion, and for other purposes.

J. A. De Val Marino, for certain improvements in the manufacture of gas, and in the apparatus employed for consuming gas, and for the purposes of producing light.

W. Pontifex, for an improvement in treating fluids containing coloring matter to obtain the coloring matter therefrom.

G. Lowe and J. Kirkham, for improvements in the manufacture of gas for the purposes of illumination.

W. G. Turner and H. Minton, for an improved propeller.

W. Wresman, for improvements in the manufacture of alum.

James Mayer, for an improved machine for cutting splints for matches.

NOTES AND NOTICES.

The Antarctic Expedition.—Letters have been received from the antarctic expedition, dated St. Helena, the beginning of February. Lieutenant Lefroy, of the Royal Artillery, who is to conduct the magnetic observatory on that island, had been landed with his instruments and assistants, and occupied Napoleon Bonaparte's house at Longwood, which has been assigned as his residence, and in the neighbourhood of which his observatory is to be built. From St. Helena Captain Ross proceeds to the Cape of Good Hope, to establish Lieutenant Eardley Wilmot, R.A., and his party, in a similar observatory, where corresponding observations are to be made during the three years in which the expedition will remain in the southern hemisphere. We understand that, by adopting proper precautions, the officers succeeded in making magnetic observations at sea with as much precision as on land, the two ships sometimes telegraphing to each other the same minute of dip. The importance of this success towards the prosecution of the objects of the voyage will be estimated when it is considered how large a portion of the southern hemisphere is covered by the sea. Captain Ross obtained soundings in the middle of the Atlantic Ocean, and far distant from any land, with a line of 2,500 fathoms, being, we believe, by far the greatest depth that has ever been reached by a sounding line.—*Literary Gazette.*

Expanding Mandrel.—The Society of Arts have awarded their large silver medal to Mr. J. Hick, jun., of Bolton, for an improved expanding mandrel for turning lathes. It is necessary that a mandrel should fit so accurately, as to bite on the inner surface with a force sufficient to counteract that of the tool, and, in the ordinary mode, the same mandrel cannot be used for two pieces which are of different diameters. Consequently, in many engineering establishments, a stock of mandrels is kept, amounting to 600 or 700. Mr. Hick purposes to do the same work with eight sizes of the mandrel, from one inch and a quarter to ten inches. He effects his object by having the spindle of the mandrel shaped on the frustrum of a cone, on the face of which are four dove-tail grooves to receive wedges, the under faces of which have the reverse inclination of the cone, so that the lines of their outside faces are always parallel with the axes of the mandrel. A nut is screwed on the spindle, which acts on the wedges through the medium of a conical cup, which drives them up to their bearings inside of the work.

Steam-boilers.—At the last sitting of the (French) Society for the encouragement of National Industry, and on the report of M. Séguier the younger, a gold medal was decreed to the elder M. Chaussenot, for an apparatus to render the explosion of steam-boilers impossible. According to the report, his invention is perfect, both as regards its improvements on the safety-valve, and an ingenious contrivance to give notice to the crew and passengers of impending danger. Even the contingency of wilful mischief is provided against; as in the event of all the warnings of his machinery failing, or being disregarded, the steam flows back upon the furnace, extinguishes the fire, and destroys all possibility of an explosion. —*Athenæum.*

Birmingham Town Hall Organ.—This magnificent instrument (described in *Mech. Mag.*, No. 554.) has lately received a most effective addition, which has indeed nearly doubled its power. This has been accomplished by a row of stupendous trumpets, constructed by Mr. Hill, on entirely novel principles, founded on a suggestion of J. F. Ledsam, Esq. The tone, is full, rich, mellow, and sweet; and although so powerful as to be nearly equal to the whole organ, it is not oppressive to the ear. Mr. Hollins has introduced it on Thursdays with much judgment and taste, to the astonishment and delight of his audiences. This invention is considered as the commencement of a new era in organ building.—*Midland Counties Herald.*

Temperature of the Ocean.—Scarcely anything is known concerning the *temperature* of the ocean as depending upon its depth; this part of the subject is still the prey of cosmogonical hypotheses. A considerable number of experiments, however, justify us in stating the following laws in regard to the heat of the superior beds of the sea. These experiments are very important in relation to the theory of physical climate:—1. The temperature of the ocean is generally lower at mid-day than that of the atmosphere, noticed in the shade. 2. It is always higher at midnight. 3. In the morning and the evening, these two temperatures are usually in accordance. 4. The mean of a given number of observations of the temperatures of the surface of the water and the atmosphere, taken at six in the morning, at noon, six in the evening and midnight, is constantly higher in the case of the sea, in whatever latitude the observations are made. 5. The mean temperature of the waters of the ocean, at their surface, and at some distance from any continent, is thus higher than that of the atmosphere with which they are in contact. 6. The sea, over a bank, is always colder than where it is deeper; and the difference is greater, the higher the bank. This curious diminution of temperature might be very useful to the navigator; it might forewarn him of unseen danger, and prove his best sounding line.—*Malte Brun and Balbi's Geography.*

Steam Ploughs.—Among the premiums to be given by the Highland and Agricultural Society of Scotland at their meeting in the present year, is one of five hundred sovereigns, "for the first successful application of steam power to the cultivation of the soil." In announcing the premium on this interesting subject, it is observed by the society, that "by the cultivation of the soil are to be understood the operations of ploughing and harrowing, or preparing the soil in an equally efficient manner, and the other purposes for which animal power is now used; and the success of the invention will be judged of in relation to its applicability to the above purposes in the ordinary situations of farms in this country, and to the saving *in time, labour*, and *outlay*, which it may possess over animal power, as now generally employed in the cultivation of the soil. The merits of the invention, with reference to the conditions enumerated, will be judged of by a committee of the society, especially appointed, and the inventor will be required to exhibit the machinery, and modes of applying it, in Scotland. The secretary, on application of intending competitors, will furnish any information which may be required. The society, in offering this premium, does not feel it to be necessary to express opinions as to the probability of a successful application of steam to tillage, as to the means by which the object may be attained, or as to the effects which might be supposed to result from the application of such a power. But it has felt it to be a duty imposed upon it by its situation, to bring the subject in a proper manner before the country, to encourage those who are now engaged in this class of experiments, and to stimulate future invention, by the offer of a premium corresponding, in some measure, to the interests and importance of the subject. Looking to the greatly extended application which has recently been made of steam as a motive power, and seeing that the difficulties which are opposed to its application to the purposes of the farm have been at least partially overcome by the efforts of individuals, it has appeared to the society, that, without exciting expectations which may not be realised, a strong ground exists for having this possible application of steam power made the subject of fair and satisfactory experiment."

Errata.—In our last number p. 531, col. 1, line 18, for "leaving," read "having." Page 533, et *passim*, for "tuns" of water, read "tons."

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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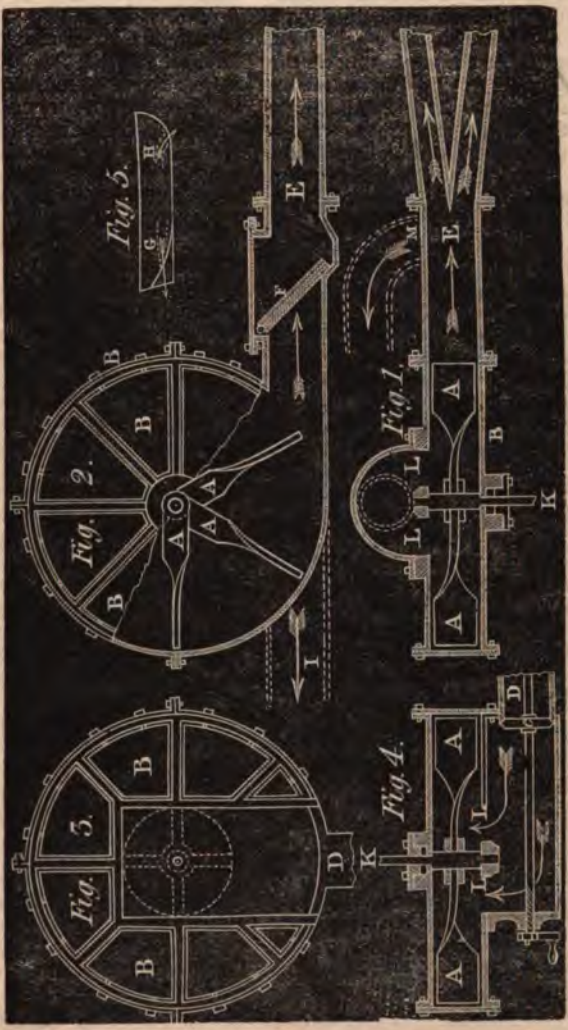
MR. TIMOTHY BURSTALL'S PATENT PROPELLERS.



DESCRIPTION OF MR. TIMOTHY BURSTALL'S PATENT METHOD OF PROPELLING.

[Communicated by the Inventor.]

Sir,—In the notes of your 870th number, dated April 11, you have given in an extract from the *Literary Gazette*, an account of a new steam-vessel, where, instead of the usual internal paddle-wheels, an "internal wheel, acting upon a current of water admitted by the bow, and thrown off at the stern propels the mass at a rapid rate." Having reason to suspect that this plan of propelling a steam-boat alludes to a patent taken out lately by an engineer in Edinburgh, and which is in all essential particulars a plagiarism of a patent of mine, sealed six or eighth months before his, perhaps you will allow me the use of your columns for recording a description of my plan, extracted from the specification of my patent, with some observations on the probable saving of power which may be looked for on this plan, in comparison with the common paddle-wheel.

Description of T. Burstall's plan of propelling, as contained in specification, and referred to in the engravings, figs. 1, 2, 3, 4 and 5:—*(See front page)*.

"The diagram exhibits my plan of propelling ships and boats on the water. Figure 1 is a sectional plan; fig. 2 an elevation, but part in section to show the paddle arms and the course of the water as indicated by the arrows; fig. 3 is a back view of the paddle case; fig. 4, a vertical section taken through the feed-pipe and centre of the paddle-wheel and case; figure 5 is an outline of a boat, showing the ends of the exit pipes, both when the vessel moves forward and back. A A A A, in figures 1, 2, and 4, are strong wrought iron radial paddle arms, inclosed in a strong water-tight case B B B, and securely fixed on the main shaft K; to this shaft is attached by belts or gearing the steam-engine, or other power; D, fig. 4, is a pipe passed through the bottom side or end of the boat to admit the water freely into the centre of the paddle case, which water will move in the direction of the arrows through the openings L L, and fill the lower part of the paddle case. On the paddle-wheel being put into rapid motion, the centrifugal motion which it will give to the water, entering by the passages will cause it to be expelled through the valve F and tube E (see figures 1 and 2) by the two passages, which two passages are intended to lead out on each side of the boat's keel near the stern and under the run. This is indicated in the outline sketch at G, figure 5, but as it is often requisite to back the boat, but at a less speed than when propelled forward. I propose to effect this in two ways, one by a branch pipe at, or about the dotted line M to lead to the bow of the vessel at H in fig. 5, which opening I propose to make pointing partly downwards, that it may be no hindrance to the progress of the vessel when propelled forward, or this end may be attained by backing the engine and sending the water through an opening which may be made at I, to be connected to the opening or openings at the bow H, as before. C is a valve in the pipe D, to be screwed down, should any thing require it to be done to the paddle-box when the vessel is afloat. F is a self-acting valve in the pipe E for the like purpose, but to enable the engineer to reverse the course of the water, slide valves must be placed in suitable and convenient situations to shut off the water one way, and open it another, but as any good water valve will do, and as any engineer can apply them to suit the vessel, they are not shown in the plan. As the object in view is to be attained by a constant emission of water, this may be done by any number of powerful pumps. If aided by an air vessel of suitable dimensions, this I claim, but not pumps by themselves, which I consider all but useless. To make this method of propelling vessels effective, it is absolutely necessary to force the water with considerable velocity, say 40 to 80 feet per second, according to the size of the boat, and the use she is intended for."

That this method of propelling steam-boats has many great advantages over the common paddle-wheel is capable, I think, of very easy demonstration—provided only, that any thing near the same free power can be got out of the steam-engine and applied to the boat. To show that this is the case is necessarily a task imposed upon me.

When we take into consideration the various points where much of the power of a steam-engine is lost without any effect

as applied to propelling steam-boats on the common plan, such as the unstable fulcrum of the water, the dip in entering it, and the lift in leaving it, I do not think it is extravagant to say, that half the power is lost; that is to say, a steam-engine of 100-horse power, which applied on board a vessel would move her by the aid of a rope winding on a barrel (if such an arrangement were possible), would be as effective as one of 200-horse applied in the usual way. In the proposed method of propelling vessels, the water may be considered to act and react on the vessel in two ways,—*first*, by striking the water, and, *secondly*, as a ponderable body put in motion, and reacting on the body from which it proceeds—just as a rocket is propelled into the air by the violent issue of the gases emitted by the burning charge, or as a piece of ordnance recoils from the discharge of the shot, in which case the velocity and weight of the shot and gunpowder is an exact measure of the velocity and weight of the cannon out of which it is fired. If we suppose a case where the exit-pipes are just equal to one superficial foot, the velocity, 45 feet per second, or 30 miles per hour, and the velocity of the boat 15 feet per second, or 10 miles per hour—then the free power to propel the boat may be calculated thus: 45 feet per second, is 2,700 cubic feet per minute; which, multiplied by 63lbs., the weight of a cubic foot of sea water is equal to 170,100lbs. of water passing through the boat; and as to give water a velocity of 45 feet per second requires a fall of 34 feet high, the power required to force it is the total weight of the water raised to that height, or $\frac{170100 \times 34}{33000}$ 175 horses: to which must be added the friction of the water in the paddle case and tubes. Now, without entering into a minute calculation, I find by the rules deduced from Colonel Beaufoy's experiments, that this would amount to about 25-horse power, or 200 horses in the whole.—To find the net power in the first place, the 25-horses power, must be deducted; and secondly, the power requisite to put 170,100lbs. in motion at the rate of the vessel's progress, or 15 feet per second, as this quantity has to be taken from a *state of rest in the sea* and to be put in *motion with the boat*. Now water attains a velocity of 15 feet per second, by falling 4 feet; this gives $\frac{170100 \times 4}{33000} =$ 21-horse power, which, added to the 25-horse friction, gives a total loss of 46 horses leaving a net power of 154, and that whether my former estimate of a loss of 50 per cent. in the common paddle-wheel is correct or not. I think it must be admitted that the loss must be more than 25 per cent., while the new plan shows less than that. To prevent any misunderstanding of what I wish to enforce, I beg to state distinctly, that this plan proceeds on the axiom that *action* and *reaction* are equal and contrary—that one pound propelled from any body with any amount of velocity, tends to remove the body from its place with a power which is just equal to the power expended in moving the pound let the velocity be great or little.

Supposing the above calculations are correct, and if they are not so, I am open to correction, there are many obvious reasons for the adoption of this plan of applying the power of steam in navigation. *First*, as most prominent, the dispensing with the enormous paddle-wheel with its iron shafts, weighty rings and boards, cumbering the vessel, making her crank and unstable on the water, shaking the vessel and all that is in it with a constant tremour. As the paddles on this plan need not be more than 1-20th of the bulk of the present ones, and will require to be placed within and near the keel of the ship—the present dock gates may be amply sufficient to take in the largest vessels which need be built; steaming and sailing may be combined in every case except in a head wind, without that loss which at present makes sails of little service to steam, as no inclination of the hull will disturb the working of the paddles. Marine engines as at present constructed, are necessarily made of much greater strength than land engines, in consequence of the shocks the paddles are liable to receive in a rough sea. On this plan the resistance will be always the same in storm or calm, let the vessel sail with or against the current; consequently, neither strength nor weight of engine will be requisite. I do not think it is an extravagant estimate to suppose that the reduction in weight, taking paddles and paddle-boxes and engine, into account, may relieve a

ship of one-third of the present gross weight of her propelling machinery.

In conclusion, I beg to inform you that I am fitting up a small iron steam-boat, which, with the same engine, will be provided with my new propeller, and paddle-wheels on the old plan, to fairly test their respective merits, and when the experiments are tried the result shall be communicated to you.

I am, Sir,
Your obedient servant,
TIMOTHY BURSTALL.

Temple Meads, Bristol, April 16, 1840.

ON THE ILLUSTRATION OF SCIENTIFIC WORKS, MODEL MAKING, &c.

Sir,—Few persons who have ever dabbled in Mechanics, will fail to be struck with the truth of the remarks made by the missionary Williams, in the highly interesting narrative of his adventures, (an extract from which appeared in your last number, page 565.) The amateur no sooner enters upon his course than he meets with some practical difficulty at the very threshold: he turns to Encyclopedias and Treatises rich in learned lore, but, unfortunately for him, they are altogether barren upon the point on which he requires assistance. It is a fact, that although numbers of our scientific works are filled with elaborate descriptions of *complex* machines, there are none that contain plain and perspicuous directions for constructing the simplest and most useful pieces of domestic machinery. Mr. Williams observes, that he examined several books without finding one which would furnish directions sufficiently explanatory for the construction of so common an article as an ordinary pair of smiths' bellows; nor do I myself know any work in our language that supplies this deficiency. That Mr. Williams did not greatly lack, either skill, perseverance, or ingenuity, is proved by what he ultimately accomplished under such disadvantageous circumstances, and therefore it is fair to conclude that when he declares himself at a loss for information, there is really a positive practical deficiency existing.

There is another defect too common in works on science generally, which I know is often productive of serious inconvenience—I allude to the wretched illustrations frequently appended to the descriptive part. It has been well observed that "one line of engraving is worth a page of letter-press," but this only holds good when the engraved lines bear some sort of resemblance to that which they are intended to represent—and when they do not give the lie direct to the descriptive portions.

In the early days of philosophical science, rudely constructed diagrams illustrating the principles of action in different machines might be tolerated, but we do not expect in 1839 to find this class of subjects worse represented than they were a century before. When we find therefore, as in some cases we do, that the illustrations of 1839 are decidedly inferior to those of 1739, are there not just grounds of complaint?

I have now before me a volume of the treatises of the Society for the Diffusion of "Useful Knowledge:" at page 14 of that on Hydraulics, I find an engraving of "*the lift and force pump*," in which the piston would seem entitled to a range of about eight inches in the stroke, while the handle as represented could not possibly accomplish above four inches; besides which, the top of the piston-rod necessarily describes an arc, while it works through a stuffing box without any parallel motion, slings, or compensating joint; so that any motion at all, in a pump constructed agreeably to this drawing, would be altogether impossible!

In this treatise we are very properly told that "when a bend or turn is necessary in a water-pipe it should be made as *gradual a curve or sweep* as possible, instead of the form of *an acute or even right angle*"—illustrated by engravings of sundry pumps and engines in which all the turnings are at *right angles* and *as sharp as possible!* Strongly reminding one of the lines—

"By our Vicar perplexed,
How can we determine,
'Watch and pray,' says the text,
Go to sleep – says the sermon."

A short time back, Messrs. Chambers undertook to publish a series of scientific treatises headed "Information for the People." What sort of information Messrs. Chambers considered the "people" to require, I know not, but judging from their treatise on Hydraulics, they hold but "sorry notions."

Perhaps it would be difficult, if not impossible, to find another printed sheet containing an equal number of incongruities; some portions of the letter-press are objectionable enough, but the "engravings" are outrageous.

I may just instance the Bramah Press, which is a perfect caricature; it is shown in the act of pressing a parcel of books, but how they are to be released from pressure does not appear, for the upper part of the piston is so much enlarged as to prevent its entering the cistern; the descent of the piston therefore being thus most effectually prevented, the books cannot, under any circumstances, be released!

It is not, unfortunately, however, the cheapest class of scientific works alone that are obnoxious to these remarks; even the seventh edition of the *Encyclopedia Britannica*, at this time publishing, is illustrated in places with wood engravings as barbarous as ever ranged with type. I will not, however, occupy farther space by enumerating particular instances; my desire is not so much to censure as to bring about an improvement in these matters. Surely there can be no lack of mechanical draughtsmen at the present day, capable of furnishing proper illustrations for scientific publications. All that seems to be required is that the drawings should be views, plans, or sections of the actual machines, and not semi-transparent hermaphrodite diagrams, bearing no shadow of resemblance to the article intended to be represented.

Although some of the treatises of the Useful Knowledge Society are very indifferently illustrated, some of them are unobjectionable—the treatises on "Heat" for example, are very well done. Their *Penny Cyclopedia* is exceedingly rich in engraved illustrations of the various objects in botany and natural history, but they seem very shy of mechanical matters, the illustrations of which, like angel visits, are "few and far between." Perhaps the engraving of "*Argand's Lamp*" is one of their best specimens, and furnishes an admirable exemplification of the species of engravings that should be employed in such works.

Young persons of a mechanical turn of mind, often find much pleasure, and acquire a large portion of practical knowledge, in the construction of working *models of various* machines in the *particular branch of* science which happens to engage their attention, and very beautiful pieces of mechanism originating in this matter are sometimes met with; persons thus engaged, continually feel the want of *more practical* drawings and descriptions, in the works they take for their guides.

The tyro, however, frequently meets with machines, or parts of machines, which require more accurate tools and greater practical skill for their efficient construction than he is master of, and he finds himself foiled in his progress from this cause. At the same time, he does not like—or in fact too often cannot afford, to avail himself of the valuable but expensive assistance of a philosophical-instrument maker. It is true, that we occasionally meet with solitary instances of triumphant genius surmounting every obstacle—such, for instance, as the ingenious *tin-plate worker* (Mr. Thomas), who a few years since made a complete set of working models in that material to illustrate the history, &c. of the steam-engine.

Amateur mechanics, and even good ones too, frequently find themselves in need of some little assistance, and I have sometimes thought it would answer the purpose of some tradesman to lay himself out for this kind of business, to keep an assortment of wheels and pinions, cylinders, pistons, screws and nuts, fly-wheels,* carriage-wheels, &c. &c., for sale at moderate prices; or who would undertake to get up any required pattern on reasonable terms.

Some little variety as to size would be requisite, but in the majority of cases, any person would most likely accommodate the proportions of his model to the size of the particular part he was compelled to purchase ready made. A pattern once made would serve for an indefinite number of castings, which would distribute an expense, always enormous, when borne by a single article, over so large a series as to be almost inappreciable.

There is a species of sectional models now deservedly coming into general use, which, on the obverse side represent the external appearance of the machine, while the reverse exhibits a section of the internal arrangements showing the mode of action. For the use of lecturers, or

* Two or three years ago I wanted to purchase a ten-inch fly-wheel for a model, and inquired all over London for it, without success.

for familiarly explaining the principles of machinery, they are unrivalled. Being put in motion by some external power, and not dependent for their action upon any force to be generated within themselves, wood, card-board, and paper enter largely into their composition, and they may be constructed in the parlour by a person acquainted with the machine to be represented, and possessed of a small share of ingenuity.

Some time since I designed a series of models of this description to illustrate the whole range of practical science; the moving power was a strong clock-spring driving a small train of wheels enclosed in a neat case, which formed a stand or pedestal for the sectional models in rotation; each one being connected with the moving power performed its proper movements and showed the entire action of the machine represented. Want of leisure has hitherto prevented me from prosecuting this idea which fully carried out, would, to a professed lecturer, be invaluable.

I remain, Sir,
Yours respectfully,
WM. BADDELEY.

London, April 25, 1840.

STEAM-ENGINE FUEL—ELERCAR FOUNDRY COKE.

Sir,—I have been reading in your 865th number, page 430, the report of Messrs. Parkes and Manby of their experiments on anthracite coal for steam-engine fuel, in which mention is made of a trial of strong foundry coke from Pontop coals, the disadvantage of using which arose from the formation of a heavy clinker on the fire-bars. It appears to me from the report, that but for the clinkers, the coke would have answered admirably, and it has occurred to me in consequence, if a coke could be procured of a strong quality which would not clink upon the fire bars, the substitution of coke for coal in marine steam-engines would in many cases be advantageous, especially in long voyages, as it would allow of the adoption of the form of boiler used by the locomotives on railways, which, I should suppose, would greatly reduce the size of the boiler per horse power of the engine, and would require much less weight of fuel to evaporate a certain quantity of water than with boilers of the present construction fed with raw coal. If any interested person would be at the trouble to try the experiment, I think he would find that the Elercar (Yorkshire) foundry coke would burn perfectly free from clinker, would not fill the engine boiler tubes with dirt, and would evaporate as much or more water per cwt. of coke than any other description of coke.

I am, Sir,
Your obedient servant,
B.

Near Rotherham, April 20, 1840.

RESISTANCE ON RAILWAYS.

Sir,—May I be allowed to call your attention to a slight oversight on the part of some of our late experimentalists upon the above subject. For instance, in the formula deduced by the Chevalier de Pambour—and subsequent experiments based on these—for determining the amount of friction on railways, he appears to have entirely overlooked one material point, viz.: that as the friction is directly as the pressing weight, it must necessarily become modified by the degree of inclination of the planes upon which that weight is placed. The fact appears also to have escaped the attention of Dr. Lardner during his recent experiments on the Whiston and Maddely planes—the results from which consequently require some correction. And, although I admit that even on the steepest railway gradients this would be of very trifling moment, still, there being an error in the general expressions given both by Dr. Lardner and the Chevalier de Pambour, the application of the formulas as they at present stand to other experiments of the same character, but where the planes are of steeper inclination than the generality of those on railways, would lead to serious misconceptions in the results.

The correction for the foregoing is simply: $\frac{F\sqrt{H^2+L^2}}{L} - F$, which is additive, or rather, $\frac{F\sqrt{H^2+L^2}}{L}$, represents the *true value* of the friction. Where $\frac{H}{L}$ denotes the numerical ratio of the height of the inclined plane to its length; W, the weight of the body; and F, the friction as already found.

I would remark that as the basis of any experiments which imply a rolling

motion down an inclined plane, the formula given by the Chevalier de Pambour, ought not to be relied on, being essentially erroneous in its premises, as was clearly demonstrated by Dr. Lardner in the last report of the British Association; nevertheless, there remains yet much credit due to the former in having been the first to indicate, and, in a measure, carry out, the *principle* by which alone experiments on this head were rendered both feasible and certain.

INDICUS.

April 18, 1840.

THE BRITISH QUEEN—LOG OF HER LAST VOYAGE—MR. SAMUEL HALL'S CONDENSERS.

Sir,—In trespassing upon your columns, for the first time, I have little apology to offer—my motives being disinterested. I write solely with the view of removing the erroneous opinions which the communications of some of your anonymous correspondents are calculated to impress upon the public mind. The fact that these communications were made under fictitious signatures at once shows that the writers were ashamed or afraid to state that openly which they made no hesitation of doing in concealment. That the writers of tho articles alluded to were either prejudiced, interested, or else entirely ignorant of the subject on which they wrote, there can be no doubt.* The anonymous letters to which I allude appeared some time ago in your pages; the tenor of these letters was an attack against Scotch engines and Scotch machinery in general, including R. Napier, Esq., and Samuel Hall, Esq., in their sweeping career. These remarks must have been the result of the reasons I have mentioned before, coupled with that jealousy which all little minds feel towards all those whom they know to be their superiors. I shall take no further notice of these writers, than by advising them to carefully peruse the following facts, of which I am proud to acknowledge myself the known author, and to compare them with the wise predictions which they so profusely indulged in, intending by them to prejudice the British Queen and all concerned in her. The same individuals express an opinion, that the best engines can be produced in London, and no where else. I will only ask them, where they can match the engines of the "British Queen" in any respect whatever, either for strength of material in proportion to their power, for beauty of design, for smoothness while in motion, and above all, for the high state of perfection in which the engines perform their duty?

The extraordinary vacuum produced in these engines is unrivalled by any engine or engines in the world. In Bedwell's Patent Barometer (a more perfect instrument for testing an engine there is not,*) shows 30½ inches; others and myself have seen it even higher than this, although 30½ inches was the mean on the last passage home. I believe it impossible, for engines on the common plan of condensation, to produce a vacuum any thing like this. The vacuum indeed, in the best sea going injection engines, *averages* only 27½ inches, and the fastest river boat on the Thames never yet exceeded it. The great increase of power, derived from the use of the Patent Condensers, is therefore self-evident. Having had the charge of another pair of engines, fitted with Mr. Hall's Condensers, viz. those of H. M. S. V. "Megæra," made by the celebrated firm of J. and S. Seaward and Co., and having experienced nearly the same result, I feel I should not be doing Mr. Hall justice if I did not express my firm belief, that if all the vessels in which his condensers were fitted, had been properly managed and understood, the same successful results would have been the consequence. I have only mentioned the *increase of power* derived from Hall's Condensers, but the numerous other advantages derived from their use, are so well known, as scarcely to require repetition—the cleaness of the boilers, the fine condition

* We differ *toto cœlo* from our correspondent on all these points. It matters not *who* calls the "cat a cat—" Jack, Tom or Harry—A, B, or C. One person too may have quite as good reason for concealing his name as another for avowing his. Position, circumstance, self-interest, and personal feeling, make all the difference. We rather think that if the whole of the good conferred on mankind by anonymous contributors could be summed up, it would be found greatly to outweigh the worth of all the genuinely subscribed and notarially attested literature in the world. It is almost unnecessary to add, that if we had thought the correspondents alluded to, were either so prejudiced or so ignorant, as our *new* and *very modest* friend alleges, their communications would not have found a place in *our pages*.—ED. M. M.

* We have in hand a description of this instrument, which we shall give in an early number.

of all the internal working parts of the engines, &c. &c. and owing to the use of distilled water only. The British Queen went from London to New York, last voyage, and returned to London with the same water in her boilers, and without the least addition of water even to start with. In fact, the boilers were not opened from the time of leaving London until her arriving there again, when the water was perfectly pure. I have never, in fact, seen any boilers so clean, and so free from deposit of any sort. It is worthy of remark, that Mr. Hall's beautiful plan of distilling *in vacuo*, not only supplied all occasional waste of water, arising from steam escaping from the safety valve, &c. but also furnished a large quantity of distilled water for the ship's use. I enclose you my log of the voyage out and home, with a copy of a certificate witnessing the extraordinary vacuum produced in the engines of the British Queen.

I am, Sir, your obedient servant,

EDWARD PETERSON.

British Queen, Blackwall, 23rd April, 1840.

Extract from Engineer's Log of the Steam Ship *British Queen*; fourth voyage from London to New York, left Portsmouth 2nd March, at 12-40 P.M.

Days of the Month.	Steam.	Expansion, how long at work.				Vacuum.	Revolutions from Indicator.	Knots.	Coals.		Miles.
1840. March.	lbs.	$\frac{2}{8}$	$\frac{3}{8}$	$\frac{4}{8}$	$\frac{5}{8}$	Inches.	No. from noon till noon.	Per hour.	Tons	cwt.	No.
3rd	5.	24	17	—	—	29	17895	9.4	36		226
4th	5.	24	—	—	—	$29\frac{3}{8}$	18480	10.2	37	10	245
5th	5.	24	—	—	—	$29\frac{3}{8}$	19495	10.2	45		246
6th	$4\frac{3}{4}$	24	—	—	—	$29\frac{3}{4}$	19505	10.	43	4	240
7th	$4\frac{3}{4}$	24	—	—	—	$29\frac{3}{4}$	19205	9.6	43	10	230
8th	$4\frac{3}{4}$	24	—	—	—	$29\frac{3}{4}$	16810	8.4	38	14	200
9th	$4\frac{3}{4}$	24	—	—	—	30	15070	7.	36		150
10th	$4\frac{3}{4}$	24	—	—	—	$29\frac{3}{4}$	16710	7.	36		154
11th	$4\frac{3}{4}$	24	4	—	—	$29\frac{3}{4}$	21340	10.	42	12	240
12th	$4\frac{3}{4}$	24	2	—	—	$29\frac{3}{4}$	18100	8.4	41	2	200
13th	$4\frac{3}{4}$	24	2	—	—	$29\frac{3}{4}$	17070	6.6	38	8	150
14th	$4\frac{3}{4}$	24	4	—	—	$29\frac{3}{4}$	17210	6.6	41	8	157
15th	$4\frac{3}{4}$	24	4	—	—	$29\frac{3}{4}$	10390	3.6	36		86
16th	$4\frac{3}{4}$	24	6	2	6	$29\frac{3}{4}$	21030	8.3	43	16	200
17th	$4\frac{3}{4}$	24	—	—	20	$30\frac{1}{8}$	23470	10.	36		240
18th	$4\frac{3}{4}$	24	—	—	23	$30\frac{3}{8}$	20070	10.	40		230

Total number of revol.tions 291850=tons 635 4 burnt; arrived off Sandy Hook on Wednesday, 18th March at 10 A.M.

E. P.

Extract of Engineer's Log of the Steam Ship *British Queen*; fourth voyage from New York to London, left New York 1st April, at 2-30, P.M. 1839.

Days of the Month.	Steam.	Expansion, how long at work.				Vacuum.	Revolutions from Indicator.	Knots.	Coals.		Miles.
1840, April.	lbs.	$\frac{2}{8}$	$\frac{3}{8}$	$\frac{4}{8}$	$\frac{5}{8}$	Inches.	No. from noon till noon.	Per hour.	Tons	cwt.	No.
2nd	4.8	22	—	—	—	30	14750	8	29	14	172
3rd	4.7	24	—	—	—	30	15750	9.4	36		225
4th	4.7	24	—	—	—	30	17500	10.2	39	12	243
5th	4.8	24	—	—	—	$29\frac{7}{8}$	15950	9.6	42		235
6th	5.	24	—	—	—	$30\frac{3}{8}$	15900	8.6	49	4	205
7th	4.5	24	—	—	—	$30\frac{1}{2}$	17600	9.	48		215
8th	4.7	24	3	—	—	$30\frac{1}{2}$	17100	8.6	42		205
9th	5.4	24	—	—	—	$30\frac{1}{4}$	18300	9.6	44	8	230
10th	5.4	24	16	—	—	$30\frac{1}{8}$	17450	8.6	46	16	204
11th	5.6	24	12	—	—	$30\frac{1}{8}$	18240	8.6	40		206
12th	5.7	24	24	—		$30\frac{3}{8}$	19660	9.2	40		220
13th	5.4	24	1	23	—	$30\frac{3}{8}$	20000	10.	43	4	240
14th	5.4	24	—	24	—	$30\frac{1}{2}$	28200	9.	36	2	216
15th	6	24	—	24	—	$30\frac{1}{2}$	19750	9.	40	16	230
16th	6	18	—	18	—	$30\frac{1}{2}$	19250	10	36		180

Total number of revolutions from New York to Portsmouth, 263,400; ditto quantity of coals tons 613, cwt. 16; arrived at Spithead on Thursday, 16th April, at 6 P.M., 1840.

E. P.

Certificate.

(Copy) *British Queen* at Sea.
April 13, 1840.

We, the undersigned, certify we have witnessed the mercury in Bedwell's patent barometer affixed to the Engines of the Steam Ship *British Queen*, standing steadily at 30½ inches.

Signed,

R. ROBERTS, R.N.
JOHN JOHNSON, Civil Engineer,
EDWARD PETERSON, Chief Engineer, B. Q.

ALEX. MENTISSLY,
D. MENTISSLY,
W. SHIRLING,
ARCHD. WEIR. } Engineers of the B. Q.

ROPE PUMPS—HALL'S HYDRAULIC BELT.

Sir,—The gentlemanly spirit, and good temper, with which "Indicus's" letter at page 537 is written, is the best possible proof that the imputation which I hazarded upon his motives in bringing forward Hall's Hydraulic Belt, was altogether unjust. So far, his letter is perfectly satisfactory, but there are other parts of it not quite so clear, and on those, I must make a few remarks.

First, "Indicus" unaccountably supposes that I calculated the velocity at one half its proper quantity: but in that he is quite mistaken; the velocity I used was 150 feet per minute, which is at the rate of 50 *double* strokes of 18 inches each: I could scarcely have erred in the velocity with "Indicus's" own estimate of the velocity of the *band* before my eyes.

Secondly, "Indicus" corrects me in *a matter of fact;* the pressures of steam in the two experiments, were, it appears, 25 inches and 30 inches; and not as I supposed 30 and 35 inches. If this were really the case, so far from the calculation being, by a "strange coincidence," nearly the same, it upsets the experiments altogether. I chose the higher pressure (5 lbs. above the average pressure of the engine, an interpretation that I think the terms of the original description will bear,) because, the result of a calculation at that pressure gave, as nearly as possible, the same rate per cent. as "Indicus" himself had stated to be the performance of the machine. I shall now subjoin the result of a calculation at the new pressures of 25 and 30 inches—and to avoid misunderstanding, I beg to state that I have used Tredgold's rules, the steps of which are as follow; and in which, if I am incorrect, I shall be glad to be set right.

25 lbs. on sq. inch $=$ 19·64 lbs. on cir. inch $+$ 11·55 lbs. for atmosphere $=$ $31{\cdot}19 \times {\cdot}536 = 16{\cdot}72$ lbs $-$ 11·55 lbs. $=$ 5·17 lbs. effective pressure $\times\ 8^2 \times 150$, velocity $=$ 499632 lbs.

The experiments ought then to stand as follow:—

	Pressure.	Effective power.	Duty.	Rate per cent.
1st trial	25 lbs.	49,632 lbs.	58,955 lbs.	(?)
2nd trial	30 lbs.	69,792 lbs.	66,755 lbs.	99¾

By this it would appear that, in the first trial, the duty performed considerably exceeded the power; while, in the second, instead of being, as stated by "Indicus," 73⅔ per cent.; it is as nearly as possible 100 per cent. There is, no doubt, some misapprehension in this, that "Indicus" can explain.

There is one more point in his letter to which I wish to advert; he states that in my estimate of the performance of the *rope pump*, quoted from a former volume of the *Mechanics' Magazine*, I have reduced "a general expression for the power of the man, from what was merely intended to denote the efficiency of the machines, &c. Now I beg to say that I made no deduction; I quoted the entire description verbatim; it closed with the relation of a simple *fact*, that such and such had been effected; I afterwards merely translated this fact into the language of comparison, and so far was I from drawing any deduction of my own from it, that I expressly regretted that the writer of the description of the rope pump had not given his authority for the *fact*.

Surely "Indicus" cannot have seen the estimates of men's strength in the *Mechanics' Magazine*, vol. xxx, pp. 237, 292, some of which range so high as 27,562 lbs. raised 1 foot in 1 minute!

NAUTILUS.

GEOLOGICAL PHENOMENON.

Sir,—I have received the following from a friend of mine, formerly a correspondent of your valuable journal, and now residing in Switzerland:—

"A very remarkable phenomenon *lately occurred* in a Gypsum quarry in *the canton of* Fribourg. The strata on which the workmen were employed were rent by several fissures of considerable length but of small diameter, from which issued strong currents of air. One of the workmen, curious to try the strength of these currents, exclaimed, as he applied a lighted torch to one of the cre-

vices, 'blow it out if you can,' but what was his astonishment when the air, instead of blowing it out, burst into a light-coloured flame, which spread rapidly over all the fissures in that part of the quarry, and which continues to burn at this moment. If the wind puts it out on any point, it reappears as soon as it ceases to blow. Several learned men, and, among others, Professor Agassiz, have already visited the quarry, but their opinion concerning the cause of this phenomenon is at present unknown. Might not the inflammable gas which issues from these fissures proceed from a coal measure in a state of ignition, situated under the strata of gypsum? This conjecture appears to me to be the more probable, as the inhabitants of the district in which the quarry in question is situated, have often experienced violent subterraneous shocks, sometimes attended with a rumbling noise which also seemed to proceed from the bowels of the earth. However, the analysis of the gas, made by scientific men, will be shortly made public."

I am, Sir,

Yours, very respectfully,

J. M.

Twickenham, April 18, 1840.

MATHEMATICAL QUESTIONS—BY ION.

Ques. 1. It is wished to know the distance between two objects, A and B, which on account of the intervening ground being irregular could not be measured; neither could they be seen from one another: two stations, C and D, were selected from which A and B could be seen, and the following observations made:—

A C 5.0 yds. A D 112 yds. $\angle$ C A D 54° 22′. $\angle$ A C B 118° 40′. $\angle$ A D B 70° 10′.

Note.—It is requested that this question may be solved by analytical trigonometry; but without the aid of the natural sines, &c., and that the advantages gained by the analytical method over that of plane trigonometry may be shown.

Ques. (2.) In White's Ephemeris the time of sun rise and sun set are given for the Observatory at Greenwich, allowances being made for celestial refraction. It is requested to give a simple formula, by which, with the aid of the *Ephemeris, a near* approximation to the time of sun rise and sun set may be found at any other place where the longitude does not differ much from that of Greenwich; also to work out an example showing how near the required formula is to the truth.

Ques. (3.) To show that there may be two or more places in the same hemisphere at any distance, say 80 miles, where the sun will rise and set on the same day simultaneously.

Ques. (4.) To what height would a person require to ascend in a balloon, that the Observatories of Greenwich and Dublin may be seen in the horizon, and what will be the latitude and longitude of the place diametrically under him?

March 10, 1840.

MR. HANCOCK'S PROCESS FOR PRINTING COLOURED PICTURES FROM ENGRAVED PLATES.

Sir,—My attention has been called to an article in the *Mechanics' Magazine* of Saturday, describing a process of printing coloured pictures from engraved plates, the invention of Mr. Charles Hancock, and for which he has obtained letters patent. I have no wish to cast any doubt on the originality of Mr. Hancock's process, in asserting that a similar method has been known to, and practised by, me for some time, but my claim to it has now become necessary as well to prevent my sinking to the level of an imitator as from other causes. I submitted specimens to several London firms, as applicable to the decoration of China and other articles, as long ago as April and May last year,* and the same plates and some of the specimens, and the letters of the parties are still in my possession.

I will take an early opportunity of sending you a specimen of a subject nearly finished, which you will find to differ (I have reason to think) in appearance from Mr. Hancock's, as my intention has not been to imitate a drawing or coloured print, and I do not confine myself to printing positive colours.

The insertion of this letter in your Magazine will much oblige, Sir,

Your obedient servant,

JAMES CONTENCIN, JUN.

28, Henry-street, Vauxhall, April 27, 1840.

* Mr. Hancock's patent was dated prior to this, namely, in January, 1839.

FRENCH PATENT LAW CASE.

(From the *Gazette des Tribunaux.*)

Is the cut of a pair of pataloons, according to a method more or less economical, an invention worthy of a patent?

This strange question being submitted to the Court of Cassation, has lately been answered in the negative, under the following circumstances:—

Heintz, a tailor in Paris, had, in 1837, obtained a patent for an economical cut of military pantaloons. The statements proving the utility of the discovery showed that it would lead to a saving of more than a fifth in the material, the amount of which, according to the inventor's calculations, would be above 10,000,000f. per annum for the Minister of War. Heintz, therefore, set a high value on the communication of his secret, and asked 800,000f. of the Minister, who refused the offer.

He soon extended his discovery to civil pantaloons, and obtained a new patent in 1838. This created a great stir in the workshops where the most indispensible part of man's attire is manufactured. Rival pretensions were brought forward, and a proceeding for infringement was instituted.

The Juge de Paix drew a distinction between the military and the civil pantaloons, and decided, that while Heintz had an exclusive right in the former, there was no infringement with respect to the latter, inasmuch as before he had obtained his patent he had given his secret to the public.

On an appeal, the Civil Tribunal of the Seine confirmed the sentence of the Juge de Paix by its decree, but the motives of the decree were different from those of the first judge, as it was considered that calculations on the best use of a piece of cloth are not a subject for legal proceeding, or fit for a patent.

This view was, perhaps, a little to general and exclusive, but, however, the motives of judgments and decrees decide nothing, and it is only against the decision itself that it is useful to appeal.

Nevertheless the judgment of the Tribunal of the Seine was referred to the Court of Cassation for a violation of the law of the 7th of January, 1791, according to which every method of perfecting any manufacture whatever, no matter how humble, is an invention worthy of a patent securing the property to the inventor. The appeal was, however, rejected by the Court of Cassation.

DURABILITY OF IRON BOATS.

The question of the durability of iron vessels, of their little liability to accident, and of the ease with which damage done to them may be repaired, appears to be very clearly proved from the experience which has already been obtained on these points; and this is no little, for there are boats built by Mr. Laird in both North and South America—in all parts of India and on the Euphrates and the Indus—in Egypt, on the Nile—and in the Mediterranean—on the Vistula, on the Shannon, and on the Thames. One of these boats on the Savannah has been constantly at work for these last six years without any repair; which is a great test, if we consider the frequent constant caulkings required to preserve a timber-built ship. There is also a steam-yacht built of iron—the Glow-worm—the property of Assheton Smith, Esq. This vessel has made the passage from Bristol to Carnarvon, a distance of 210 miles, in 18 hours. In the Report to the House of Commons on Steam-vessel Accidents, we find the following stated of the Garryowen, one of these vessels:—"We went ashore about two cables' length to the eastward of the pier (Kilrush), and struck very heavy for the first hour. The ground under our weather-bilge was rather soft clay, covered with shingle and loose stones, some of them pretty large. Under our inside, or lee-bilge, the ground was very hard, being a footpath at low water. I was greatly afraid she would be very much injured by it in her bottom, but I am happy to say she has not received any injury; in fact, her bottom is as perfect and as good as on the day she left Liverpool—not a single rivet started, nor a rivet-head flown off. If an oak vessel, with the cargo I had on deck, was to go on shore where the Garryowen did, and get such a hammering, they would have a different story to tell. . . . Out of 27 vessels that got ashore that night, the Garryowen is the only one that is not damaged more or less."

Colonel Chesney, the commander of the Euphrates expedition, writes thus of the iron vessels which were employed on that service:—"It is but right to tell you that the iron vessels constructed by you far exceeded my expectations, as well as those of the naval officers employed in the late expedition, who would one and all bear testimony anywhere to their extraordinary solidity; indeed, it was often repeated by Lieut. Cleaveland, and the others, that any wooden vessel must have been destroyed before the service was one-half completed—whereas the Euphrates was as perfect when they laid her up at Bagdad as the first day she was floated.—*Mr. Cruise*, United Service Journal for May.

On the Regulator of Clock-work for effecting uniform movement of Equatorials. By G. B. Airy, Esq., Astronomer Royal. Read before the Astronomical Society. (From the *Athenæum.*)

The subject of this communication is a mathematical investigation of a mechanical problem of great importance in practical astronomy. The author remarks, that the accuracy given to a most delicate and valuable species of observations, by the use of clock-work attached to equatorials, is so great, and the importance of the application so evident, that any investigation which assists in elucidating the principles on which such apparatus should be constructed, and especially any which points out the nature of one important defect to which it maybe liable, cannot but be regarded as interesting to the practical astronomer and the instrument-maker. After adverting to the different methods of giving motion by a train of wheel-work to the polar axis of the equatorial, which have been adopted in the principal instruments hitherto erected, the author proceeds to consider the various means which have been put in practice for effecting this regulation. In the mountings constructed by Fraunhofer, the axis of the regulator is vertical; it carries a horizontal cross arm, to the extremities of which are attached springs, nearly transverse in direction to the cross arm, carrying at the ends small weights. When the regulator is made to revolve with a certain velocity, the centrifugal force of the balls bends the springs till the balls just touch the inner surface of a drum which surrounds the regulator: the smallest additional velocity causes the balls to press against the drum and create a friction which immediately reduces the velocity; and the drum is made slightly conical, so that by raising or depressing it the velocity may be altered at pleasure. This construction not only partakes of the defects common to all the others, but is liable besides to this peculiar objection, that the determinate rate will depend most essentially on the strength of the springs, and will therefore depend on temperature and other varying causes. The other constructions (which were practically introduced by Mr. Sheepshanks) depend upon the same principle as that of the governor of the steam-engine. Two balls suspended from the upper part of a vertical axis, by rods of a certain length, are made to expand by the rotatory velocity of the axis; and this expansion, when it reaches a certain extent, is made to press a lever against some revolving part, and thereby *to create a friction which immediately checks the velocity.* In some cases the balls are suspended by rods from the extremities of a horizontal arm carried by the vertical axis. This construction, adopted in the south equatoreal of the Royal Observatory may be considered analogous to Fraunhofer's, substituting for the springs the gravity of the balls;—a change which can hardly fail to be advantageous. Now, the uniformity of rotatory motion of the spindle, in these various constructions, depends entirely on this assumption; that if, upon the whole, the retarding forces are equal to the accelerating forces, the revolving balls will move in a circle and in no other curve. But this assumption is not correct. If, for instance, we consider the case of balls, suspended as in the governor of the steam-engine: the motion of each of the balls may be the same (omitting the moments of inertia of the various parts of the machine, which are trifling) as that of a ball, suspended by a tring, and put in motion by an arbitrary impulse; and a ball so suspended may move in a curve differing insensibly from an ellipse. Now, this elliptic motion actually takes place. In some instances, observed by the author, the balls of the regulator, instead of revolving in a circle, revolved in an ellipse of considerable eccentricity, and the rotatory motion of the spindle was therefore exceedingly variable. The effect of this irregularity on the motion of the equatorial, whether the inequalities of motion are followed by the polar axis, or merely communicate a general tremor to the frame, must be injurious. The inequality now mentioned is only one case of a very extensive theorem, which may be thus enunciated:—"Whenever the equilibrium of forces requires that a free body be brought to a determinate position, either absolute or relative to other parts of the mechanism with which it may be connected, the body will not remain steadily in that position of equilibrium, but will oscillate on both sides of that position, and (so far as the action of those forces affect it) will have no tendency to settle itself in the position of equilibrium." This theorem supposes that some cause of disturbance has once put the body into a state of oscillation; and renders it necessary to take account of such oscillations in planning any mechanism which depends upon assuming the position of equilibrium to be nearly preserved. If we examine the theory of the regulator, we shall see that the friction which checks the motion takes place when the balls are most distant from the axis, and (as the equable description of areas is nearly observed) this occurs when the angular motion is least. The whole maintaining force acts without check when the balls are nearest to the axis,

that is, when the angular motion is greatest. Therefore, when the angular motionis least, the acting forces tend still to diminish it; when greatest they tend to increase it. Hence the inequalities of angular motion will increase till some new forces come into play, which act in some different manner: and thus is explained the obstinate adherence of the governor balls in some cases to their elliptic motion. The author next proceeds to consider the ways in which an attempt may be made to counteract the injurious effects of such oscillations. These appear to be only two: one, to make the oscillations of velocity much slower (or to make their periodic time longer); the other, to make the oscillations quicker (or to make their periodic time shorter.) The first of these methods has the effect of giving greater smoothness to the motion (an object of great importance); and it is the principle which was adopted with success in the clock-work of the Cambridge equatoreal. The second method endangers the smoothness of the motion; but, as the error has but a short time for accumulation, it ensures that the object shall remain steady under the view of the telescope far more completely than the first. The construction attached to the clock-work of the south equatoreal of the Royal Observatory is on this principle; and it appears to answer extremely well. The mathematical problem proposed by the author in the present communication is an investigation into the motion of governor balls, for the purpose of deducing the time of rotation corresponding to a given expansion of the balls, and the periodic time of their oscillations, and the consequent oscillations in the angular speed of the spindle; and the subject is discussed on four different suppositions, which, with their several principal results, are as follows:—1. When the balls are supposed to be acted upon by no forces. The result is, that the periodic time of oscillation is somewhat greater than half the time of rotation. 2. When the axis which carries the balls has a fly-wheel attached to it. In this case the periodic time of the oscillations cannot be less than half the time of rotation, and may be in any proportion greater. 3. When the balls are suspended by rods from a horizontal arm carried by the regular spindle. The result is, that the periodic time of the oscillation may be made small in any proportion to the time of rotation. 4. On an assumed law of accelerating force and retarding friction. The result is, that the effect of these forces is to increase *continually* the inequality of motion.

LIST OF ENGLISH PATENTS GRANTED BETWEEN THE 26TH OF MARCH AND 27TH OF APRIL, 1840.

John Bethell, of Saint John's Hill, Wandsworth, gent., for improvements in treating and preparing certain oils and fatty matters. March 28; six months to specify.

Claude Joseph Edmed Chaudron Junot, of Brewer street, Golden-square, operative chemist, for certain improved processes for purifying and also for solidifying tallows, grease, oils, and oleaginous substances. March 30; six months.

Henry Martin, of Morton Terrace, Camden Town, for improvements in preparing surfaces of paper. March 30; six months.

William Neale Clay, of Humby, gent., for improvements in the manufacture of iron. March 31; six months.

John Leberecht Steinhaueser, of Upper Islington Terrace, gent., for improvements in spinning and doubling wool, cotton, silk and other fibrous materials, being a communication from a foreigner residing abroad. March 31; six months.

Peter Bancroft, of Liverpool, merchant, and John Mac Innes, of the same place, manufacturing chemist, for an improved method of renovating or restoring animal charcoal after it has been used in certain processes or manufactures, to which charcoal is now generally applied, and thereby recovering the properties of such animal charcoal, and rendering it again fit for similar uses. March 31; six months.

Charles Cummins, of Leadenhall-street, chronometer maker, for certain improvements in barometers and sympiesometers. April 2; six months.

James Stead Crosland, of Leeds, engineer, for certain improvements applicable to locomotive and other steam-engines. April 2; six months.

Thomas Smedley, of Holywell, gentleman, for improvements in the manufacture of tubes, pipes, and cylinders. April 4; six months.

Harrison Blair, of Kearsley, manufacturing chemist, and Henry Hough Watson, of Little Bolton, chemist, for an improvement or improvements in the manufacture of sulphuric acid, crystallized soda, and soda ash, and the recovery of a residuum or residuums applicable to various useful purposes. April 6; six months.

Richard Beard, of Egremont-place, New-road, gentleman, for improvements in printing calicoes and other fabrics, being a communication from a foreigner residing abroad. April 6; six months.

Edward Thomas Bainbridge, of Park-place, Saint James, gentleman, for improvements in obtaining power. April 13; six months.

Thomas Young, of Queen-street, London, merchant, for improvements in lamps. April 13; six months.

James Caldwell, of Mill-place, Commercial-road, engineer, for improvements in cranes, windlasses, and capstans. April 15; six months.

John Gold, of Etna Glass Works, Birmingham, glass manufacturer, for improvements in the manufacture of decanters and other articles of glass. April 15; six months.

William Potts, of Birmingham, brass founder, for certain apparatus for suspending pictures and curtains. April 15; six months.

Louis August de St. Sylvain Baron de los Valles, of Nottingham-street, Marylebone, for certain improvements in cleansing, decorticating, purifying, and preserving corn and other grain, being a communication from a foreigner residing abroad. April 15; six months.

William Grimman, of Camden-street, Islington, modeller, for a new mode of wood paving. April 15; six months.

Thomas Robinson Williams, of Cheapside, gentleman, for certain improvements in obtaining power from steam and other elastic vapours or fluids and for the means employed in generating such vapours or fluids, and also for using these improvements in

conjunction with distillation or evaporation, and other useful purposes. April 15; six months.

Joseph Whitworth, of Manchester, engineer, for certain improvements in machinery, or apparatus for cleaning and repairing roads or ways, and which machinery is also applicable to other purposes. April 15; six months.

William Unsworth, of Derby, silk lace manufacturer, for an improved tag for laces. April 15; six months.

William Henry Bailey Webster, of Ipswich, surgeon, for improvements in preparing skins and other animal matters for the purposes of tanning and the manufacture of gelatine. April 16; six months.

Samuel Marlow Banks, of Bilston, gent., for improvements in the manufacture of iron. April 15; six months.

Samuel Wilkes, of Darleston, iron founder, for improvements in the manufacture of vices. April 16; six months.

Robert Cooper, of Petworth, Gloucester, gent., for improvements in ploughs April 16; six months.

Francis Molineux, of Walbrook Buildings, for improvements in the manufacture of candles, and in the means of consuming tallow, and other substances for the purposes of light. April 23; six months.

Elijah Galloway, of Manchester-street, Gray's Inn Road, engineer, for improvements in steam-engines, which are also applicable to engines for raising and forcing fluids. April 23; six months.

Jonathan Sparke, of Langley Mills, Northumberland, agent, for certain improved processes or operations for smelting lead ores. April 23; six months.

John White, of Manchester, engineer, for certain improvements in vices. April 23; six months.

James Malcolm Rymer, of Henrietta-street, Bloomsbury, civil engineer, for certain improvements in castors for furniture, such improved castors being applicable to other purposes. April 23; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND BETWEEN 22ND OF MARCH, AND 23RD OF APRIL, 1840.

Sir William Burnett, of Somerset House, for improvements in preserving animal, vegetable, woollen, and other fibrous substances from decay. Sealed 25th March; four months to specify.

Peter Lomax, of Little Bolton, weaver, for certain improvements in looms for weaving. March 26.

Peter Bancroft, of Liverpool, merchant, and John Mac Innes of the same place, manufacturing chemist, for an improved method of renovating or restoring animal charcoal after it has been used in certain processes or manufactures to which charcoal is now generally applied, and thereby recovering the properties of such animal charcoal, and rendering it again fit for similar uses. April 6.

William Hunt, of the Portugal Hotel, Fleet-street, London, manufacturing chemist, for improvements in the manufacture of potash and soda and their carbonates. April 11.

Thomas Robinson Williams, of Cheapside, London, gent., for certain improvements in the manufacture of woollen and other fabric or fabrics, of which wool or fur form a principal component part, and in the machinery employed for effecting that object. April 11.

Henry Philip Rouquette, of Norfolk-street, Strand, merchant, being a communication from abroad, for a new pigment. April 18.

William Stone, of Winsley, county of Wilts, gent., for improvements in the manufacture of wine. April 20.

Pierre Auguste Ducote, of No. 70, Saint Martin's Lane, lithographer, for certain improvements in printing china, porcelain, earthenware, and other like wares; and for printing on paper, calicoes, silks, woollens, oil-cloths, leather and other fabrics; and for an improved material to be used in printing. April 20.

John Inkson, of Ryder-street, St. James's, gent., being a communication from abroad, for improvements in apparatus for consuming gas, for the purposes of light. April 20.

Jean Francois Victor Fabien, of King William-street, London, gent., being a communication from abroad, for improvements in rotary engines, to be worked by steam, or other fluid. April 20.

Matthew Uzielli, of King William-street, city of London, merchant, being a communication from abroad, for certain improvements in the arrangement and construction of ships'-hearths, or apparatus for cooking, and for obtaining distilled or pure water from salt or impure water. April 22.

Thomas Aitken, of Chadderton, in the county of Lancaster, manufacturer, for certain improvements in the machinery, or apparatus for drawing cotton, and other fibrous substances. April 22.

NOTES AND NOTICES.

Death of Mr. Roberts, Inventor of the Miner's Hood, and Improver of the Safety Lamp.—Died, on the 14th ult., at Bilston, Staffordshire, Mr. John Roberts, aged 49. About 20 years ago, when Roberts invented his admirable safety-hood, he was a common miner in the Whitehaven collieries, and inhabited one of those small cottages adjoining the gates of the glass-house yard—Ginns. His first experiment was made in a building in the yard, the floor of which was covered with a quantity of straw, thickly strewn with sulphur. The straw was set on fire, and when the atmosphere of the room was so oppressive as to drive the bystanders from the floor-way, Roberts, equipped in his hood, entered, and the door being closed, remained upwards of 20 minutes, without inconvenience, in a place where no living creature could have existed one-fourth of the time. By these, however (to their shame be it spoken), who ought to have duly appreciated the merits of his invention, Roberts and his hood were treated with neglect; and had not Mr. Ledger (Editor of the *Whitehaven Gazette*) interested himself in his behalf, he might have remained unnoticed and unknown. Mr. Ledger having witnessed some experiments with the apparatus, and being fully convinced of its utility, introduced it to the notice of the late J. C. Curwen, Esq., M.P., who, we believe, was the means of bringing it under the inspection of different scientific bodies in London, Dublin, and Paris, before whom Roberts put the powers of his hood to the test in many severe experimental trials. He was warmly applauded by the gentlemen who witnessed these trials, and was, we are informed, rewarded in a handsome manner for his invention. The Duke of Sussex, as President of the Royal Society, presented him with a gold medal, in token of the approbation of the members of that institution.—"As a means of preserving life in mines, after an explosion, and in buildings when on fire—inasmuch as it enables the wearer to remain for a considerable time in safety in situations where it would be impossible to breathe an instant without such a safeguard—the safety-hood is unquestionably entitled to rank amongst the most useful inventions of modern times. How far it has been introduced into practical use we are not prepared to say, but certain we are it is deserving of, and will one day obtain a due meed of public celebrity."—*Whitehaven Herald.*

Steam Ploughing—On Saturday last a trial was made in one of the fields on the estate of Fossil, near Glasgow, of the steam-plough, intended for the cultivation of the sugar lands of British Guiana. This trial was completely successful, and gave

great satisfaction to the numerous party who witnessed it, among whom we observed Colonel Campbell of Fossil. The field was laid out similar to those in the colony, which has canals on each side running parallel with one another. The machinery consists of two iron boats, one containing a small high pressure steam engine, with a drum, round which the endless chain or rope is coiled, and the other a reversing pully, by means of which the chain or rope is extended, and allowed to work which ever way is required; the ploughs are attached to this chain, and made to work backwards and forwards with great rapidity and accuracy. Mr. M'Rae, whose long residence in the colony and great practical experience of the working of the sugar estates had directed his attention, for a considerable time past, to the great and absolute necessity of employing some other power to supersede cultivation by manual labour, invented the steam plough, which was executed by those enterprising engineers Messrs. Thomas Edington and Sons, Phœnix Ironworks, whose great ingenuity in constructing and designing the various parts was very much admired.—*Glasgow Courier.*

Wyrley and Birmingham Canals.—About twelve months ago an arrangement was made for consolidating the Wyrley and Essington Canal Company with the Birmingham Canal Company, and we observe that on the 14th instant the Act of Parliament for carrying that arrangement into effect received the royal assent. This union will not only be of great advantage to the proprietors, but also to the public, as the united company are going to lay out upwards of £120,000 in making two new lines of canal to connect the Wyrley and Essington canal with the lower level of the Birmingham canal, by one of which the mines in the neighbourhood of Wednesfield and Willenhall will be brought into the market; and by the other the lower part of the town of Birmingham may be supplied with coal from the extensive and valuable mines at Brownhills and Cannock Chase.—*Wolverhampton Chronicle.*

Substitutes for Hemp.—The African Bow String Hemp has been proposed as a substitute for the *phormium tenax*, or New Zealand flax, and its fibre is stated to be of nearly equally good quality. This is confirmed by the nearly allied Indian species of Sanseviera;—S. Roxburghiana, S. Moorva, &c.; yielding it of a fine and at the same time of very strong quality, fitted for bowstrings, fishing-lines, as well as for cordage, which indeed is made from it on the Coromandel coast. Dr. Roxburgh is of opinion that the fine fibres called China grass are made from this plant, and Mr. Greenlaw, Secretary to the Marine Board, (India) states that it is proposed to try the fibre of S. Roxburghiana on a large scale for ropes.—*Prof. Royle's Botany of the Himalayan Mountains.*

The Grasses, the most natural of all orders are the most extensively diffused, and at the same time the most useful of vegetables. They are extremely numerous, nearly two thousand species being at present known, and thus forming nearly one-twentieth of the plants described in systematic works; but if the number of individuals be considered, the proportion is immensely greater. They are found in all parts of the world both on land and in water, in dry and in moist situations, in hot and cold, tropical and temperate climates, though different tribes, genera, and species inhabit those several situations. Their culture forms the greater portion of the agriculture of all countries, and has, in Europe, been studied to an extent and with a care to which the agriculture of the East is a stranger.—*Dr. Royle's Himalayan Mountains.*

The Indian Rhinoceros, the Unicorn of Fabulous History.—The Indian Rhinoceros affords a remarkable instance of the obstructions which the progress of knowledge may suffer, and the gross absurdities which not unfrequently result from the wrong application of a name. This animal, to whose horn the superstition of the Persians and Arabs has in all ages attributed peculiar virtues, became known to the Greeks through the description of Ctesias, a credulous physician of that nation, who appears to have resided at the court of Persia in the time of the younger Cyrus, about 400 years before the birth of Christ. His account, though mixed up with a great deal of credulous absurdity, contains a very valuable and perfectly recognizable description of the Rhinoceros, under the ridiculous name however of the *Indian Ass;* and as he attributed to it a whole hoof like the horse, and a single horn in the forehead, speculation required but one step further to produce the fabulous Unicorn, such as it appears in the Royal Arms of England, and such as it has retained its hold on popular credulity for the last two thousand years.—*Mr. Ogilby.*—*Dr. Royle's Natural History of the Himalayan Mountains.*

Gloucester and Hereford Canal.—About five hundred men are now employed in the continuation of the canal from Ledbury to Hereford. Nearly the whole of the first seven miles is in progress: the works at present are confined to this portion, because the supply of water will be obtained by it, not only for the new part, but also for the sixteen miles from Ledbury to Gloucester; it is therefore anticipated that this additional supply will cause a considerable increase of revenue. The most important works at present under hand are the embankment across the Leadon Valley, at Prior's Court, and the deep cutting at Ashperton. The weather has lately been favourable for the work, and the great progress already made has surprised many persons; part of the line is quite finished, and light boats constructed so as to be easily moved from place to place, are now being used on the finished portion, for the purpose of shifting soil and materials. Patent bricks for facing the locks are being made at Ledbury. The bricks are very superior to any before seen in this county. They are moulded in the usual way, and when in a particular state of dryness they are forced by a heavy weight into a metal mould, which operation not only brings the brick into a perfectly true and square shape, with a fine smooth surface, but also condenses the clay, thereby making the brick stronger and more durable.—*Hereford Times.*

Extraordinary Temperature of April.

	Lowest at night.	Highest in the shade	Highest in the sun.
April 22 ..	48	65	86
23 ..	48	67	97
24 ..	49	74	105
25 ..	49	75	114*
26 ..	49	72	99
27 ..	49	73	107
28 ..	47	75	113

The greatest degree of heat in the sun last year was upon the 18th of June, when the mercury reached 111 degrees of Fahrenheit; but on Saturday last the index reached 114, being 3 degrees higher than any one day last year.—*Correspondent of the Times.*

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 874.] SATURDAY, MAY 9, 1840. [Price 3*d*.

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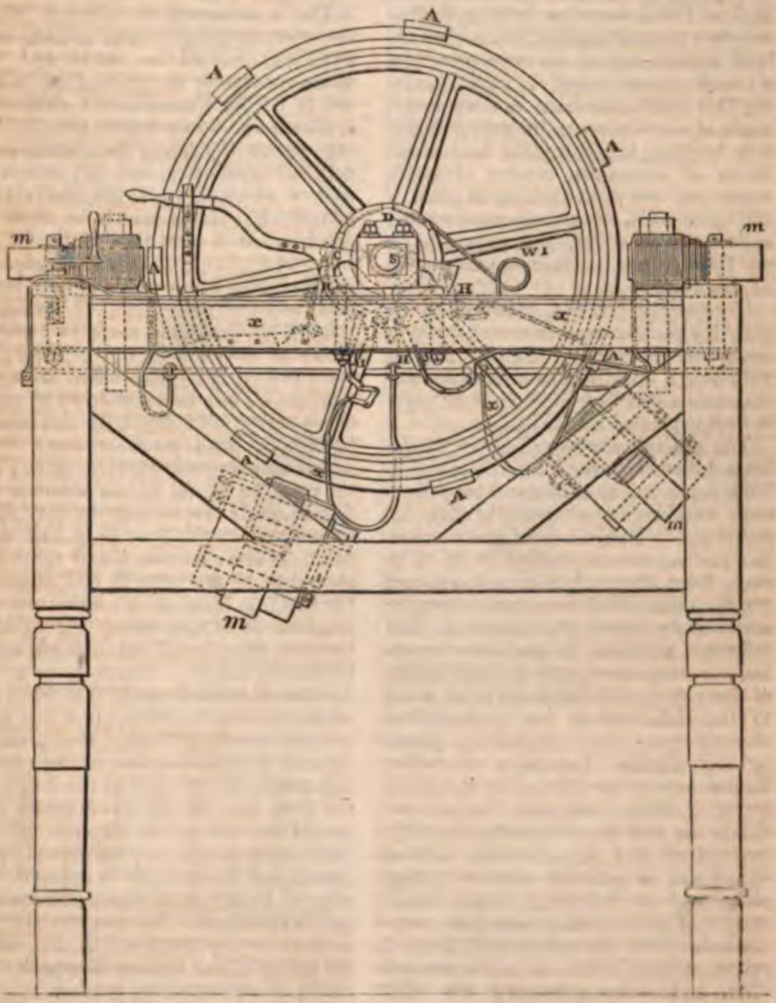
TAYLOR'S ELECTRO-MAGNETIC ENGINE.



TAYLOR'S ELECTRO-MAGNETIC ENGINE.

[Patent dated Nov. 2, 1839; Specification sealed May 2, 1840.]

We have now the pleasure of laying before our readers the first authentic and complete account of the first electro-magnetic engine which has been yet produced, capable of being practically applied as a motive power to machinery. The patentee (W. H. Taylor, Esq., late of New York) describes in his specification two sorts of engines, but as they are both constructed on the same principle, we shall content ourselves with describing that which has been exhibited this week at the Coliseum in active operation, turning, to the wonder and admiration of thousands, articles of wood, metal, and ivory; and which, in point of arrangement is, in our judgment, greatly superior to the other. The engraving on our front page is a correct representation of this engine.

The peculiar principle of action, which gives the present invention such a superiority over all previous contrivances, for obtaining a working power from electro-magnetism (the best of them mere toys) is thus explained by Mr. Taylor.

The generality of the plans which have been hitherto devised for the purpose, have depended, he states, and we believe truly, as taking advantage of *the change of polarity*, of which masses of iron fitted as electro-magnets are susceptible so as to cause them alternately to attract and repel certain other electro-magnets brought successively within the sphere of their influence, and thus to produce a continuous rotary movement; and the failure of these attempts he assumes to be owing to the difficulty, if not impossibility of multiplying or accumulating power by such means. Instead of this, Mr. Taylor employs as his prime movers, a series of electro-magnets, "which are alternately and (almost) instantaneously magnetized and demagnetized *without any change of polarity whatever taking place*, and in bringing certain other masses of iron or electro-magnets, successively under the influence of the said prime movers when in a magnetized state, and indemagnetizing the said prime movers as soon (or nearly so) and as often as their attractive power ceases to operate with advantage." Or, "*in other*" and perhaps plainer "words," his invention consists "in letting on or cutting off a stream of the electric fluid, in such alternate quick and regular succession to and from a series of electro-magnets, that they act always attractively or positively only, or with such a preponderance of positive attraction, as to exercise an uniform moving force upon any number of masses of iron or magnets, placed so as to be conveniently acted upon."

The electro-magnets through which the electric fluid is transmitted, may be either caused to rotate, and the masses of iron or electro-magnets, which are to be acted upon made stationary, or *vice versa*. In the engine now exhibiting at the Coliseum, the electro-magnets are stationary, and the masses of iron on which they act, are fitted on the rim of the wheel, which is made to revolve. M M M M (see figure on the front page), are four electro-magnets of equal size fixed in a suitable frame-work. A A, are the pieces of (soft wrought) iron called armatures, seven in number, let in or attached to the periphery of the wheel W, at equal distances from one another. The wheel should be of metal or wood, but if of metal, the rim should be covered with wood or some other non-conducting substance, so as to place the metal parts out of the magnetic influence. Mr. Taylor prefers that these armatures should have only half their depth let into the wheel, and that they should be of the breadth and height of the two iron faces, of one of the electro-magnets M M, (including the interval between these faces) and in depth equal to half the height. The magnets are so fixed in the frame-work, that when the wheel revolves, the armatures just pass without touching them. The distance between the centre points of two adjoining armatures, is, equal to the height of the iron faces of all the magnets employed, so that as the magnets pull in succession, the pull may commence when the edge of an armature is opposite the edge of a magnet, in which position the pull is strongest. The magnets are also so fixed in the frame-work, that when the centre of one of them is opposite the centre of an armature, another magnet shall have one of its edges just opposite the edge of an armature, and a third its contrary edge opposite a contrary edge of another armature, while a

fourth magnet is directly in the centre between the two. D is a disk, divided into twice as many parts as there are armatures, each part being alternately copper and ivory. In place of ivory, any other non-conducting substance may be substituted. The size of the external rim of the copper parts bears the same proportion to that of the ivory, as the rim of the armatures is to the curved interval between them. The disk is keyed to the shaft S and revolves with the wheel. H H H H, are four bent copper bolts or hammers, each connected with the extremities of the wires on one pole of each of the electro-magnets; the extremities of the wires on the other pole of each magnet being joined by screws or soldering to a wire or wires *x x x x:* which go at once to one pole of the battery. The hammers H H H H, are moveable on pivots attached to a frame C, and are kept pressing against the external periphery of the disk by springs, as shown in the figure. The hammers are placed at such distances from each other, that each of them respectively just begins to touch the copper portion of the disk, when the magnet, to which it is attached, is in the position with regard to the armatures before described; and it is found, that by the adoption of the proportions before laid down, when the centre of any armature is opposite the centre of any magnet, the hammer connected with it, just rests on the ivory portion of the periphery of the wheel, whereby the magnetism is suspended, so as to allow the armature to pass freely while another copper portion of the disk is advancing under another hammer, whereby the succeeding magnet becomes charged in its turn; and so on successively. To produce a reverse action of the wheel, the semi-circular frame C, which supports the hammers, is made to slide by the action of the handle as shown in the figure. If moved, so that the hammers shall be shifted a space equal to half the external rim of any of the copper parts of the disk, the magnets are charged after the armatures are opposite the magnets, and a back action is engendered, by which the wheel is soon stopped. And if the frame be moved, so that the hammers are shifted a space equal to the *whole* rim of one of the copper points of the disk, then the magnets are *charged and suspended* at their proper intervals as before, and a reverse action of the wheel is produced. W W is a copper wire which proceeds from one of the holes of the battery, and is made to press by a spring against the inner copper part R of the disk, which, projects a little in that part for the wire to rest upon.

When the machine is in operation the electric current proceeds from the battery along the copper wire W through the copper of the disk, along the copper hammer, which is in contact with any copper segment of the disk, and through the copper wire proceeding from the said hammer round the magnet, along the wires *x x x* to the opposite pole of the battery.

The general result of the very ingenious arrangements we have thus described, is exceedingly striking. Nothing can be more continuously regular or beautiful than the motion imparted to the wheel—the agent (unlike fire, water, or steam) invisible, yet its effects palpable to the senses—capable of being called instantaneously into action (no time lost in getting up the steam,) and of being as instantaneously brought to a dead stop. The power realized in the machine at the Coliseum is certainly small—not we should imagine more than one man's power; and what the cost may be at which it is obtained we have yet to learn. That an excess of power, however, is produced much beyond what is required for the revolution of the wheel itself, is abundantly proved by the work done by the machine; and we can see nothing in the principle of the invention which should prevent this power being multiplied to any desired extent. A battery of adequate sustaining power, neither too costly nor too bulky, is all that is wanted; and from the great advances which have been recently made in this department of electro-magnetic science, we cannot allow ourselves to doubt that every difficulty on this head will be soon removed. Some time ago it was said that professor Jacobi had invented a platina battery of such small dimensions that one of a horse's power might be comprehended within the space of a man's hat; and the battery of Mr. Smee, of which we gave an account a week or two ago, is described as producing all the advantages of a platina battery, at a cost of less than a halfpenny per square inch.

It is scarcely necessary to add that the engine is a distinct thing from the battery which furnishes the electric fluid; in the same way as a steam-engine is technically considered a distinct thing from the boiler whence it draws its supplies of steam. Mr. Taylor confines his claim to the invention of the engine, and holds himself free to employ whatever battery may be found best suited to his purpose.

ROPE PUMPS—REPLY TO NAUTILUS.

Sir,—In self justification I am bound to give an early reply to the letter of your correspondent "Nautilus," p. 686, more especially, as from that, it would at the first glance appear I had been guilty of something beyond a mere *verbal* inaccuracy. Indeed I was fearful that from a too slight and hasty reference to my notes, I might have carelessly attributed a mistake to him where the error was entirely on my own side. But upon recurring to my original memoranda of the experiments, I find that 25lbs. and 30lbs. were, notwithstanding "Nautilus's" calculated conclusion as to their absurdity—*the true conditions*, and those upon which I had founded my previous estimates of the relative effects of the band and pump. He will not, therefore, be surprised, that it should have appeared to me somewhat strange, that with so wide a difference of data; there should, nevertheless, be such a similarity of results in our calculations, nor that I could only account for this by the probability of an erroneous impression on the part of "Nautilus," respecting the velocity of the piston.

May I ask where "Nautilus" obtained his rule for calculating the power of the engine? To me it is not a little inexplicable, for I cannot imagine, that even Tredgold, with his, at all times liberal estimate of waste, &c., would knowingly have given only about one-fourth of the whole pressure in the boiler as the efficiency of the engine. I think that by a more careful reference to Tredgold, page 176, last edition, he will find the formula for *non-condensing* engines acting at full pressure to be somewhat equivalent to the following:—

$(\phi \times .6 - 11.5 \times .4) \times a^2 \times v =$ power of the engines in lbs. raised one foot high per minute, where $\phi =$ excess in boiler per circular inch above atmospheric pressure, $a =$ diameter of piston, and $v =$ velocity in feet per minute.

Hence, by substitution and completing the indicated operations, we obtain for

	Pressure.	Sufficiency.	Duty.	Rate per cent.
1st Trial	25lbs.	68925lbs.	58968	$85\frac{1}{2}$
2nd Trial	30lbs.	91488lbs.	67485	$73\frac{3}{5}$

the same as before.

Therefore, as to the degree of "*misapprehension*," or where it may rest, it must remain for "Nautilus" to determine. In the mean time I am unavoidably compelled to retain my first opinion of the rather "strange coincidence" in our results.

As regards any conclusions deducible from the trials I witnessed, I beg to repeat, that they must be considered of merely an approximative character. The experiments were not made with sufficient strictness to constitute a rigid and final test of the capabilities of the machine, which I have no doubt is yet capable of much improvement. The most effective degree of immersion for the lower drum should be clearly ascertained; much depends on this, since each additional inch of depth beyond what is absolutely requisite, would but increase the friction and resistance from the water. It should also be ascertained whether there exists any dependent ratio of the height of lift to the velocity and breadth of band. Moreover, in instituting the comparison between the working of the band and a pump similarly circumstanced, 50 strokes per minute can hardly be considered as the most advantageous velocity for the latter.

I must again remark, that Tredgold, in his rule for *non-condensing* engines, appears to have made a more than ample allowance for loss, &c.,* and that it would be scarcely fair at all times to deduce a per centage of duty from the effective power, as calculated by his formula, since I conceive it would not be *impossible* under the circumstances to arrive at a case where the former might even materially exceed the latter.

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* Vide Chevalier de Pambour's "New Theory of the Steam Engine."

I must advert to a plan which is adopted in the present instance for comparing the amount of duty with the power, being by a lever attached to the plummer-block of the crank axle. I believe this plan was suggested by Mr. Donkin. Although ingenious and admirably adapted for the purpose as far as it goes, it is I fear liable to be misunderstood as regards the real extent of its object, which it should be remembered, is but to indicate the *constant amount of resistance* at that point. Now to get at the true value of that resistance, it must be reduced *to the velocity of the band*—the friction of the engine and other parts of the machine having as it were already been accounted for. The duty performed when taken relatively to this, must it is obvious, be essentially different from the same duty compared in the usual manner, and it must therefore be altogether fallacious as a measure of the power of the engine. Any difference then, between the duty or power in this case, is due to the deficiency of the belt *per se* (in common with all other machines not boasting of the condition of a *perfect* agent), and this difference can relate only to the *power* obtained at Mr. Donkin's point of resistance, irrespective of the amount previously expended in overcoming the inertia of the large driving wheel and the friction of the crank-shaft on its bearings (which must be *added* before we can obtain its real relative value as an hydraulic engine). I hazard this opinion with much diffidence—and open to correction, for it is probable, during a cursory examination, that I may have misconceived the precise principle of its application.

With respect to the estimates of human strength to which "Nautilus" refers me, I admit that results so enormous might possibly be realized by unusual exertion for a limited period, but they can scarcely be considered as affording grounds for any legitimate induction on the subject, being but the *temporary* and concentrated exertion of the whole force of the individual. The sole purport, in my opinion, of giving a dynamical unit, under any circumstance, is to have a general exponent by which we can form some analogous measure of animal power, when regularly and continuously exerted. It cannot, therefore, fairly be applicable to a momentary and violent strain of the muscles; and is only calculated to mislead. But in this case the experiments, I believe, were specially directed to determining the effect of *temporary* in contradistinction to *continuous* efforts. However I must not be tempted into a subject involving so much of interesting discussion; suffice it for the present to observe, that from the result of some enquiries into which I had occasion some time since to enter, I am strongly disposed to infer, that the ordinary estimate of animal power is by far too high.

INDICUS.

May 4, 1840.

SMEETON'S METALLIC SHANK BUTTON

[Design Registered, April, 1840.]

Sir,—I have made it a matter of consideration for some time to effect an improvement in the shanks of buttons, which, as at present constructed, are very faulty, and I am happy to say I have succeeded in designing an entirely new and very superior shank, for which I have obtained protection under the new Designs Registration Act; I have submitted it to most of the first-rate tailors, button manufacturers, &c., and it has met with their warmest approval.

The great defects of the present shank are, first, that being of a loop form and of rigid substance, it turns more or less round with every pull or strain, causing the button either to hang or stand awry; and, second, that from its continual friction upon the button-hole—that masterpiece and best ornament of every garment—it wears and destroys it long before any other part.

Now my new shank is altogether free from these defects. It is of a cylindrical form, of the same length as usual (the old loop included) and at the end it has four small eye-holes placed at right angles to one another, through which the thread is passed, which secures it to the cloth. A bottom view of the end of my shank exhibits the appearance of a cross [÷|÷] with one eye-hole in each angle. When a button with this shank is sewn on, it stands so firm that you cannot by any ordinary pressure to which such buttons are exposed, cause it to change its original position; and being precisely of the same form as the button-

hole, it works in it with comparatively but little friction.

The perpetual complaints to which the trade are subjected in consequence of the old absurd button shank, will by the use of my improved design be entirely done away with. It is, Sir, as you observed, and as every competent person to whom I have shown it agrees, a real and valuable improvement, though in but a trifling article. No man of the world will, I am sure, after knowing its merits, forget to order "Smeeton's Metallic Shank Button."

I remain, Sir,
Yours, respectfully,
J. SMEETON.

12, St. Mary Axe, May 4, 1840.

[The reader will excuse a tailor—inventor's enthusiasm. The Smeeton shank is really a most useful improvement. ED. M. M.]

RACE BETWEEN THE "RUBY," GRAVESEND STEAMER (OAK BUILT), AND THE "ORWELL" AND "SONS OF THE THAMES," IRON STEAMERS.

Sir—As there has been of late so much swaggering and boasting of the superiority of iron steam-boats over those of wood, and as one of the principal advantages claimed, is stated to be much greater lightness and decrease in draught of water, and consequently greater speed; I shall feel obliged to you if you will give insertion in the pages of your useful journal, to the following account of a run which took place on Saturday last, May 2nd, between the *Ruby*, and two of the crack iron steamers.

I should premise that the *Ruby* has been built three years, and she has now commenced running for the fourth season, and that no vessel has yet been found that can compete with her. She is timber built of English oak plank, upon the improved diagonal plan adopted by the Diamond and Woolwich Companies —a plan I have no hesitation in saying stronger, more durable, and superior to that of any combination of iron whatever. She has never been caulked since the day she was launched, nor a farthing laid out in repairs, and her lines are as true as when they were first laid down on the shipwright's floor.

As the *Ruby* has been lying by some time to refit for the season, the owners of the two iron boats alluded to, took the opportunity of announcing their respective craft as the fastest vessels in the kingdom, but the *Ruby* has again taken her place as No. 1, and, like a giant refreshed with sleep, goes better and faster than ever, and the drubbing she has given the *Orwell* and *Sons of the Thames* will no doubt cause their respective partisans to alter their tone for the future.

In conclusion, I have only to repeat the challenge which has appeared in different public journals for the last three years, that I am ready to match the *Ruby* to run from Gravesend to Margate and back, for 200 guineas, against any steam-boat afloat, whatever may be her size, power, or build.

I am, Sir,
Your obedient servant,
A. BILLINGS,
Secretary of the Diamond Steam-boat Company.

Race between the "Ruby" and the "Orwell."

1st Trial.—On Saturday, at 8 P.M., the *Ruby* got under weigh from Blackwall, and proceeded slowly down the river, to enable the *Orwell* to come up, as she was to start from London at eight o'clock.

The *Ruby* went half speed down to Long Reach, no *Orwell* in sight, then tried the mile one hour after flood, spring tide, came back as far as the Half-Way House, and discovered the *Orwell* coming down with plenty of smoke and steam; turned round the *Ruby*, and went on ½ speed till the *Orwell* was just four boats astern at Erith, off Cold Harbour Point. Set off full speed, with strong flood tide, two hours flood (the reason of placing the *Ruby* ahead was the fear of hugging, as both were near the shore.) The *Ruby's* engines went off in fine style,—31 strokes, and she soon began to draw away perceptibly from the *Orwell*, (the *Orwell's* people at this time hoisted the jack at the main;) however, when off Purfleet, the *Ruby* had gained a quarter of a mile upon the latter vessel, the jack was hauled down, and the *Ruby*, as the conqueror, hoisted hers. The *Ruby* gradually gained upon her antagonist, till

she stopped at Gravesend Town Pier, when, by observations made, the *Orwell* was 1½ miles astern, and by time eight minutes as she passed the Town Pier:—thus beating the *Orwell* in a run of 14 miles about 1½ miles, the distance of four boats' length having to be deducted, which was the distance the *Ruby* was ahead when the race began. The *Ruby* ran the whole distance against a strong flood tide and wind ahead, in one hour ten minutes, being seven minutes less time than the *Orwell*.

2nd Trial from Gravesend.—The *Ruby* having stopped ten minutes at Gravesend Town Pier, allowed the *Orwell* time to come up on the opposite shore and pass Tilbury Fort, when she again started for the chace, and by the time the *Ruby* had crossed the river against the strong flood in the stream, the *Orwell* was one mile ahead. The *Ruby* then ran on for forty-five minutes, in which time she caught the *Orwell*, and went right by her neck and neck, (you might have tossed a biscuit from one vessel to another,) headed her by a quarter of a mile, turned round and was back to Gravesend in seventy minutes. In this second race she beat the *Orwell* 1 mile in 45 minutes; from the above, it will appear that the *Ruby*, against tide, is full 1½ miles per hour faster than her antagonist.

Race with the "Sons of the Thames."

The *Ruby* waited at Gravesend till 4 o'clock, and then started up the river to meet the *Sons of the Thames*. The *Sons of the Thames* and the *Mercury* left London at 5 P. M., and at 40 minutes past 5, they were both discerned at the bottom of Woolwich Reach, the *Sons of the Thames* full a quarter of a mile ahead of the *Mercury*. Some colliers being in the stream prevented the *Ruby* being turned round so soon as she ought to have been, so that when the vessel was got round with her head down, the *Sons of the Thames* was a quarter of a mile ahead, and the *Mercury* was just alongside, all three going full speed, and the tide running down strong. It was now evident by the *Ruby* drawing away from the *Mercury* that she was gaining fast upon the *Sons of the Thames*, which vessel the *Ruby* came up to in 15 minutes, when the *Sons of the Thames* had a half minute stop and the *Ruby* shot by her, and continued to gain upon her, till the arrival at Gravesend Town Pier, when the *Ruby* was 1 mile ahead. It should be observed that, at Greenhithe, the *Sons of the Thames* had another short stop, but as she was going all the time with the tide, both these stoppages could not have made more than 1 minute's difference.

The whole distance was done by the *Ruby*, from the bottom of Woolwich Reach in 55 minutes.

General Remarks.

It is right to observe, that during the above races, the *Orwell* apparently had 100 persons on board, and the *Sons of the Thames* about 50, whilst the *Ruby* had none but her crew.

To some this may appear an advantage for the *Ruby*, but the advantage would have been more in favour of the *Ruby* if she had had 200 persons on board, as her paddles would then have had more hold of the water, and the vessel would have consequently gone faster; as during the race the *Ruby's* engines were overrunning their speed for want of proper resistance to the wheels. The *Ruby's* best speed is when she has 300 persons on board; in proof of which, the *Ruby* started from Gravesend on Sunday night last, with 300 passengers on board, half an-hour after the *Sons of the Thames* had left, and arrived at London Bridge within three minutes of the time that the latter reached there, the *Ruby* thus beating the *Sons of the Thames* 27 minutes in the whole distance, which was entirely against a strong ebb tide.

RAIN GAUGES.

Sir,—In turning over the pages of your useful miscellany, I find at page 163, vol. viii, the following method of constructing a rain gauge:—

"Take a funnel whose opening is exactly ten square inches, and fix it in a bottle; as the rain descends it will fall into the funnel, and from thence into the collecting vessel. The quantity of rain caught is ascertained by multiplying the weight in ounces by .173, which gives the depth in inches and parts of an inch."

This rule will be limited in its usefulness from the circumstance that parties wishing to construct such a gauge may not be able to command a funnel the

area of whose opening is precisely ten inches. How many shops may require to be searched before one can be found, or who will undertake to make one, the diameter of whose opening shall be 3.568 inches? In these circumstances it occurs to me that a method of finding a multiplier adapted to any other area of funnel may be acceptable. If you are of the same mind, I shall feel obliged by your giving insertion to the following:—

Let d=the diameter of the opening of the funnel; then will $d^2 \times .7854 =$ its area. Also, let $a =$ the altitude of the column of rain fallen; then will its contents, or the quantity received by the funnel, be expressed by $a\ d^2 \times .7854$. Now, a cubic foot, or 1728 cubic inches of water weigh 1000 ounces avoirdupois. Therefore, to find the weight of the quantity of rain received by the funnel, we have the following analogy:—

$1728 : ad^2 \times .7854 :: 1000 : ad^2 \times .454$. That is, calling the weight w, $ad^2 \times .454 = w$. Whence, $a = \frac{w}{d^2 \times .454} = w \times \frac{2.2}{d^2}$. Hence, the rule is: *Divide the constant quantity 2.2 by the square of the diameter of the funnel; the quotient will be a number by which, if the weight in ounces of the rain in the receiving vessel be multiplied, the product will be the height in inches of the column of rain fallen.*

This multiplier once found, it will be advisable to inscribe it on a conspicuous part of the funnel to which it corresponds.

To exemplify the rule, I may give an example: Suppose the diameter of the funnel is $6\frac{1}{2}$ or 6.5 inches. Then $\overline{6.5}|^2 = 42.25$; and $\frac{2.2}{42.25} = .052$, the multiplier required. Or take as another example the funnel, the area of whose opening is 10 inches. The area being equal to $d^2 \times .7854$, we have $\frac{10}{.7854} = 12.7324 = d^2$. Hence, $\frac{2.2}{12.7324} = .1728$, the correct multiplier, instead of .173, as stated in the article I have quoted. Now if the rain collected in the receiving vessel weigh $27\frac{1}{2}$ or 27.5 ounces, we have in the case of the first funnel, $27.5 \times .052 = 1.43$ inches; and in the case of the second, $27.5 \times .1728 = 4.752$.

I am, Sir, your obedient servant,

Q.

Aberdeen, May 4, 1840.

LOACH AND CLARKE'S PATENT PULLEY-RACK FOR BLINDS.

"I'm glad to make them known."—*Byron.*

Sir,—Stepping into Henly and Co.'s in Blackfriars-road the other day to purchase some pulley-racks for blinds, they introduced to my notice a novelty in this line, the merits of which were so palpable, that there remained no question as to which I was to purchase—the old or the new principle. The superiority of the latter was so decided that I did not long halt between two opinions, but willingly paid the few extra pence and possessed myself of a *quantum suf.* of Messrs. Loach and Clarke's patent blind pulleys. If ever there was an article of which it might be said that it was time for it to fall into the march of improvement, this was most assuredly the case with blind-pulleys. As heretofore made, they were always either too slack or too tight—the spring was broken, or the rack stripped, or something or other was continually wrong so as to render them a source of external annoyance. Messrs. Loach and Clarke have, however, greatly simplified and perfected this article, as will be apparent on examining the accompanying sketch. A A, is a plain

brass plate, bent up so as to form two side grooves, in which the pulley B slides freely up and down. C, is a brass wedge with a projecting thumb-piece; this wedge insinuates itself between the brass plate and the back of the pulley, setting it fast at any part of its range. The rack is affixed to the sash-frame with a couple of screws in the usual manner; the line being slipped under the pulley-wheel, it is pressed down till sufficient tension is produced, the wedge C following it secures it in the exact place to which it has been depressed. To cast off the line, raise the wedge C, and the pulley will be instantly set free, admitting the line to be taken on and off without dividing and rejoining. The ingenuity and simplicity of this contrivance strongly commend it to public favour; it is neat in appearance, moderate in price, and not likely to get out of order.

Since the above was written, I have seen a window-fastener by the same gentleman, made upon the wedge principle, which is also a really useful and meritorious contrivance, in many respects surpassing its predecessors.

I remain, Sir, yours respectfully,

WM. BADDELEY.

London, April 23, 1840.

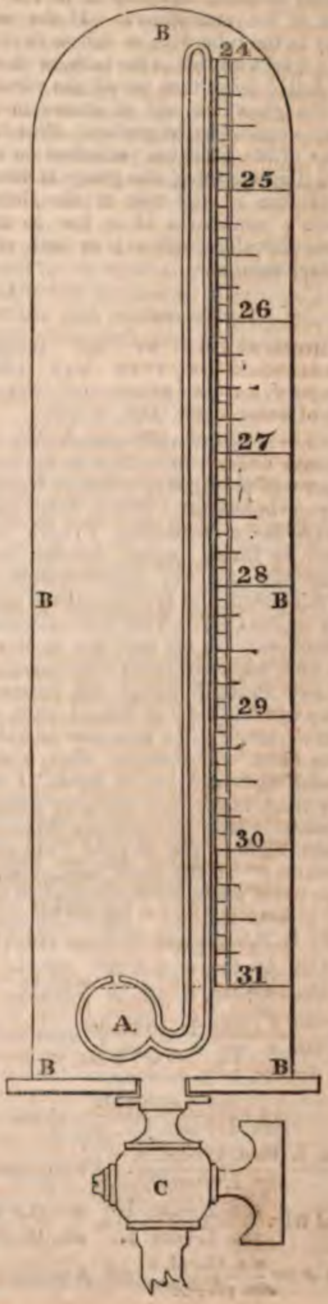
BEDWELL'S PATENT STEAM-ENGINE BAROMETER.

The engraving on the opposite column represents the patent Steam-Engine Barometer mentioned in our last number as being employed on board the *British Queen*.

A is a bulb with a hermetically sealed tube, the former being partially, and the latter entirely filled with mercury.

B B an air tight-glass casing, in which the above is enclosed.

C, a cock by which the casing B may be connected with the vacuum or condensers of steam engines. Like the common atmospheric barometer, this gauge is graduated to 31 inches. To compare, therefore, the vacuum shown by the atmospheric steam-gauge with that shown by Bedwell's gauge, a deduction must be made from the latter of as much mercury as the state of the atmosphere causes to fall in the atmospheric barometer below 31 inches. The peculiarity in this gauge is, that it shows the approximation of the vacuum of a



steam-engine toward a perfect or Torricellian vacuum, independant of the action of the atmosphere. If the mercury in the tube were to fall so as to be on a level with that in the bulb, as shown by dotted lines, then would the vacuum in the glass case, and of course in the engine condenser be perfect. From the letter of Mr. Peterson published in our last, it appears that this gauge indicated a vacuum in the case of the *British Queen's* condensers of as low as 30½, being therefore within ½ an inch of a perfect vacuum.

L.

DEMONSTRATION OF MR. SCOTT'S SOLUTION OF IVER MAC IVER'S QUESTION IN SPHERICAL TRIGONOMETRY—(NO. 858, P. 242.)

Sir,—It is generally considered a hazardous attempt to be first in the field, if not well prepared to refute all charges of your opponents. But as there must always be a beginning, I have ventured to thrust myself forward as a competitor for the demonstration of G. S.'s solution of Iver Mac Iver's question in No. 867. This you may deem presumption on my part, but as this is the case, when any thing new comes out or any stranger makes his entrance, every one has a hit at him, I must expect to receive a few raps now and then from older contributors. But with a "bold heart and steady hand," I will defy them to produce a plainer demonstration. This declaration, will, no doubt, nettle a few of your "old contributors;" at the same time, also, I hope it will produce a demonstration that will give G. S. some "salt for his egg."

By G. S.'s general theorem, No. 858.

$$\frac{\text{Cos. A}-\text{tan. }x\text{ . sin. A}}{\text{Cos. A}+\text{tan. }x\text{ . sin. A}}=\frac{\text{tan. L}'}{\text{tan. L}}$$

$$\frac{1-\text{tan. }x\text{ . tan. A}}{1+\text{tan. }x\text{ . tan. A}}=\frac{\text{tan. L}'}{\text{tan. L}}\text{ from which}$$

are deduce, tang. x. =

$$\frac{\text{tan. L}-\text{tan. L}'}{(\text{tan. L}+\text{tan. L}')\text{ . tan. A}}=$$

$$\frac{(\text{tan. L}-\text{tan. L}')\text{ cot. A}}{\text{tan. L}+\text{tan. L}'}.$$ But by analytical trig. $\frac{\text{tan. L}-\text{tan. L}'}{\text{tan. L}+\text{tan. L}'}=\frac{\text{sin. (L}-\text{L}')}{\text{sin. (L}+\text{L}')}$

$$\textit{tan. }x=\frac{\text{sin. (L}-\text{L}')}{\text{sin. (L}+\text{L}')}\text{, cot. A or tan. }x=$$

$\text{cosec. (L}+\text{L}')\text{ . sin. (L}-\text{L}')\text{ cot. A}$; where (L+L′) and (L—L′) are the sum and difference of the latitudes of the two places, and A their difference of longitude.

I am, Sir, yours, &c.

A LATE PUPIL OF KING'S COLLEGE.

May 4, 1840.

MR. SAMUEL HALL'S REEFING PADDLE-WHEELS.

We have now before us the specification of Mr. Hall's Reefing Paddle-wheel, which we noticed with so much approbation a short time back. We still think very highly of it, but must beg leave to place on record a considerable qualification of the opinion we formerly expressed respecting the originality of the invention, and more especially the supposed difference between it and the wheel of Mr. Holebrook.

Mr. Hall thus describes the objects or nature of his invention:—

"The objects of my improvements in propelling consist, *first*, in the withdrawing of the float-boards more or less from the peripheries of paddle-wheels toward their centres, and in the returning of them back again at pleasure for the purpose of regulating the depth of their immersion in the water wherein the vessel to which they are applied is floating, according to circumstances, such as the depth of water the vessel is drawing, the roughness of the sea, the violence of the weather, or any other occurrence which may take place to render such regulations of the situations of the float-boards desirable.

"*Secondly*, not only in the regulating of the float-boards as above described, but in the withdrawing of them entirely out of the water, or as nearly so as possible, when any circumstances render it desirable, such, for instance, as when the wind is so favourable as to render it desirable to sail the vessel entirely thereby, and to cease altogether during that time from working the engines, and when that is no longer the case, in the returning of the boards to their proper situations in the water for the engines to be put in operation."

So far as regards the first of these heads,—which constitutes by far the most valuable feature of Mr. Hall's invention, it differs in nothing from that of Mr. Holebrook; the "*objects*" of both wheels are precisely the same (see description of Mr. Holebrook's wheel, Mechanics' Magazine, vol. xxx, p. 385); neither is there anything new in the

second object, of raising the float-boards altogether out of the water, whatever novelty or merit there may be in the particular plan proposed by Mr. Hall.

To protrude or withdraw the float-boards of a paddle-wheel at pleasure (erroneously called reefing, which means something rather different), Mr. Hall adopts the following plan. To each side of the wheel, he attaches a smaller wheel or disk of about one-third the size, on the inner face of which there is *a continuous groove of a spiral form;* each of the float-boards he connects to a flat bar which slides steadily up and down straight grooves made in the arms of the wheel; and to the inner ends of these sliding bars, there are curved strips of metal attached, which take into and work in one or other of the spiral grooves before mentioned. The means by which the sliding bars are moved to and fro, (slide-boxes, toothed-wheels, &c.) it is unnecessary to describe in detail; *the spiral grooves* constituting that master feature of the invention by which it is distinguishable from all others. These spiral grooves Mr. Hall observes "must exactly correspond with and face each other, so that when the metallic strips of one set of sliding-bars are brought as near to the centre of the paddle-wheel as the grooves will allow, the other set in the other wheel will still be in a corresponding situation; thus in that situation as well as in all others, the two wheels containing the spiral grooves, which are connected together by a coupling-box, will cause the strips and of course (through the means of the sliding-bars) each end of the float-boards respectively to assume a corresponding situation. It will be apparent, that when the spiral wheels turn round along with the arms and other parts of the paddle-wheel, the boards will not have any traversing motion given to them toward or from the paddle shaft. But it will be evident, that if on the one hand, the two spiral wheels be put in motion, while the paddle-wheel is at rest; or on the other hand, if the two spiral wheels be retained at rest while the paddle-wheels are in operation, the float-boards may be moved inwards or outwards by means of the curved strips of iron traversing on the spiral grooves, and thereby moving the slide bars and the float boards, with which such bars are connected."

To raise the paddle-boards altogether out of the water, with the view of propelling a vessel by wind instead of steam, Mr. Hall makes use of two shafts coupled by cranks, one directly connected with the engine or moving power, and the other carrying the paddle-wheel, so that by disconnecting the two shafts, the paddle-wheel can be raised "by any suitable means"—altogether we humbly submit a most objectionable arrangement.

We now come to Mr. Hall's "claim" wherein he states what he considers to belong to him exclusively as being of his invention, and as covered by his letters patent. We shall give it in his own words.

"Having thus described the various parts of the apparatus which constitute my improvements in propelling, I now proceed to define and explain the extent of my claims, and that in numerical order, claiming every one of them, independent of each other, as respectively new and useful inventions. They consist, FIRST, *in any suitable inclined or incurvated eccentric surface or surfaces* for sliding the floatboards of paddle-wheels, inwards or outwards, *in whatever manner the inclined or incurvated eccentric surface or surfaces*, may be formed or applied, whether in the form of a single spiral groove, as shown in this specification, or of *two, three, or some other number of spiral grooves*, or whether the spiral or spirals be in the form of a groove or grooves, as abovementioned, formed in a wheel or boss, as herein described, or of a spiral or spirals projecting from, instead of sinking into such wheel or boss, *or in whatever other form it may be applied.* It may be proper here to remark that when the spiral or spirals are in the form or forms of a groove or grooves, only one of the curved metallic strips is necessary to be applied to each of the slide-bars, to move or traverse in its respective groove, but that when the spirals project from the wheels, two such metallic strips are necessary, between which each of the projecting spirals is clasped, and travels to move the slide-bars inwards or outwards.

"SECONDLY—I claim the combination of *any inclined eccentric surface* or surfaces, as above described, with the arrangement of toothed wheels herein delineated, or *any other suitable arrangement of machinery*, for putting the inclined or incurvated eccentric surface or surfaces in motion, or for stopping them *for the purpose of sliding the floatboards of paddle-wheels inwards or outwards*, either while the engines and paddle-

wheels are at rest, or while they are in motion, and without the necessity of stopping them as in the former case, viz., while the sliding of the floatboard is effected, as would be necessary were the inclined or incurvated eccentric surface or surfaces only applied, without the arrangement of toothed wheels herein delineated, or some other suitable machinery for effecting the same purpose.

"THIRDLY—I claim the slide-boxes and springs hereinbefore described, or any other suitable elastic material, for the purpose of attaching the floatboards firmly to the paddle-wheel arms, and at the same time of allowing such float-boards to slide backwards and forwards on them with sufficient ease. Similar springs or elastic material, the use of which I also claim, may be applied at the sides as well as on the edges of the paddle-arms, and I make my claim to this mode of attaching the floatboards to paddle-wheels, whether in connection with my invention as before described or not, and whether for moving or reefing them, by any other machinery, or by manual labour; and I claim this plan, even as a mode of fastening the floatboards, and without moving them or reefing them at all.

"FOURTHLY—I claim the method herein described, of connecting and disconnecting the paddle-wheel shaft and the main shaft, whether in connection with my reefing paddle-wheels, as herein described, or with any other kind of wheels or mode of propelling, to which such method of connecting or disconnecting the paddle-wheel shaft, and the engine-shaft is applicable.

"FIFTHLY—I claim the above means of moving or reefing floatboards for water-wheels for propelling machinery and other purposes, as well as for paddle-wheels for propelling boats, ships, or other vessels.

"SIXTHLY—I claim the abovementioned means of sliding the floatboards, whether for the purpose of regulating the depth of their immersion in the water, or for the purpose of taking them out of the water altogether, or as nearly as possible, when required; whether for the purpose of allowing a steam-vessel to be propelled by the wind only, or for any other reason.

"I would here observe, that I do not limit my claims to the precise means or apparatus, or arrangement thereof, which I have described in this specification for the attainment of all or any of the various objects abovementioned, *as they are susceptible of many variations of form and mode of application*, which are essentially and substantially the same, as those which I have given as instances of my improvements, and the adoption of any of such variations would, as I consider, be as much infringements of my patent as the use of any of the precise means, apparatus and arrangement which I have herein delineated and described."

When we saw a model of Mr. Hall's wheel (before the specification of it was enrolled) we were so much struck with the simplicity, beauty, and efficiency of the spiral movement, and it presented at first sight so little resemblance to anything we had seen before, that we did not hesitate to say we thought it not only an excellent invention, but entirely "original;" (*Mech. Mag.*, March, 1840); and we are still of opinion that it presents the best plan of protruding and withdrawing paddle-boards at pleasure, which has been yet proposed. But now that we learn from Mr. Hall's enrolled specification the full extent of what he considers to be exclusively his own, we must confess that we are greatly startled and amazed, and cannot go half—nay nine-tenths of the length—which he *insists* we ought to go with him. "*Any* suitable inclined or incurvated eccentric surface or surfaces" "in *whatever manner*" such surface or surfaces "may be formed or applied"! Why, if this claim could stand good then Mr. Hall's patent would put an extinguisher on Mr. Holebrook's plan, which depends as much as Mr. Hall's does on the employment of "inclined or incurvated eccentric surfaces," (though in "the manner" they may, and do certainly, differ); but there is this slight obstacle in the way, that Mr. Holebrook's plan, which equally with Mr. Hall's is protected by patent, is *of long prior date*. Mr. Holebrook's patent may perchance extinguish Mr. Hall's, but it is utterly impossible that Hall's can ever extinguish Holebrook's. Had Mr. Holebrook brought forward his wheel *after* the appearance of Mr. Hall's, it would undoubtedly have been an infringement of Mr. Hall's patent; but it follows by a parity of reasoning that Holebrook having *preceded* Hall in the employment of "inclined or incurvated eccentric surfaces," Hall must be the infringer and not Holebrook. Or if we admit, as for ourselves we readily do, that Mr. Hall has improved upon the plan of Mr. Holebrook—still he can only use his improvement subject to any prior right which Mr. Holebrook may have to the use of "inclined or incurvated surfaces" gene-

rally—such prior right being precisely the same which Mr. Hall, forgetful of Mr. Holebrook's priority, now seeks to set up and establish for himself. Mr. Hall's spiral grooves act precisely on the same principle as Mr. Holebrook's screws; the one invention is nothing more nor less than the other in a more simplified and enlarged form. We did not detect this identity of principle at first sight—this we freely confess—but now that Mr. Hall has forced the matter on our attentive consideration by the terms of his claim—far-stretched, wide-sweeping, and ultra-possessive beyond any claim we ever read—it appears to us, as we doubt not it will do to every one in the least conversant with mechanical geometry, a thing as clear as day. Having unintentionally done Mr. Holebrook a great injustice in what we before said as to the entire difference between the principle of his wheel and that of Mr. Hall, we feel that we do no more than our duty in setting him, as well as ourselves, right with the public. For Mr. Hall's sake, whom we have the pleasure of knowing, and highly respect, we should have been glad to say less; but we believe and trust we have not said more than the pressing justice of the case demands.

IRON STEAM-BOATS — OSCILLATING CYLINDERS.

An iron steam-boat, called the *Courier*, intended to navigate the Elbe, between Hamburgh and Magdeburgh, has just been launched from the building yard of Messrs. Ditchburn and Co., Blackwall, and fitted with engines on the oscillating principle by Messrs. John Penn and Son, of Greenwich, who have acquired great eminence for the construction of this class of engines. The vessel is 158 feet long at the water line, her breadth of beam 20 feet, and her draft of water with engines, boilers filled, &c. and 15 tons of fuel on board, is only 19 inches in midships, and 14 inches at stem and stern. The engines are of 32 horse power each; the diameter of the cylinders 34 inches; and the length of stroke 3 feet. The weight of the engines and boilers filled with water is only 37 tons 15 cwt.; and they are well accommodated in an engine-room of half the usual size. The great saving thus effected in weight and space is one of the results of the adoption of the oscillating principle, and may be ranked among its principal advantages. The weight usually assigned, we believe, to river engines is 18 cwt. per horse power, but we were informed that the oscillating engines of the *Courier* weigh under 12 cwt. The paddle-wheels are 15 feet in diameter; the paddle-boards 8 feet long, and 13¾ wide.

A first trial was made with this boat after her steam machinery had been all fixed in, on Wednesday last (30th April), and here we must not omit to notice, as an instance of dispatch which is well deserving of imitation (for which it must be confessed there is but too much room) that the engines and boilers were fixed in and started in five days after the vessel was launched. The vessel started from Geeenwich pier with a numerous party of gentlemen on board, friends of the builders and engineers, at one o'clock P.M., and performed the distance to Gravesend with the steam at a pressure of 5½ lbs., at the rate of 11⅓ miles an hour. The workmanship and working of the engines were both greatly admired; though of course they could not be expected to perform so well as they will do, after they have been some little time in use. On the return of the vessel to Greenwich, the company partook of a handsome collation on deck, at which Mr. Penn, senior, presided. The health of the Manufacturers of the Engines having been drunk, the chairman, in returning thanks, very handsomely acknowledged that whatever merit there might be in their construction, it was entirely due to his son, with whom the management of the manufacturing details of the establishment of Messrs. Penn and Son, entirely rested. A similar compliment having been paid to Mr. Farey, who was present, and had taken great pains to time the performance of the engines exactly, that gentleman passed a warm encomium on the manner of their construction and efficiency of their performance. "It was the business of others to make engines, it was his to record and criticise their productions; and seldom had he found more room for praise, or less for censure, than on the present occasion." The healths of Messrs. Ditchburn and Co., the builders of the boat; of Mr. Kuhne, the agent for the foreign owners; of the Directors of the

London and Westminster Steam-boat Company, whose boats, Star-light, Day-light, &c., are all fitted with engines on the oscillating plan, and from the workshop of Messrs. Penn and Son, were also drunk and suitably acknowledged.

Messrs. Penn and Son have, we understand, completed and set to work no less than 17 pairs of these oscillating engines; and have orders for many more in hand.

SUSPENSION BRIDGES.

*Letter from Lord Western to Lord Melbourne, descriptive of a Suspension Bridge on a new principle, built across the Avon, at Bath, by Mr. Dredge. (Slightly abridged.)**

My Dear Lord,—Having heard that Government is about to expend a further sum of money on the reparation of the Menai bridge, which is said to be in a perilous state, I cannot refrain from entreating your attention to the vast improvement that has been made in the construction of suspension bridges, by Mr. Dredge, of Bath. During a recent residence of two months in that city, I have had an opportunity of seeing often the bridge that has been built by him across the Avon; it is a beautiful structure, and at once commands admiration by its beauty, and inspires confidence in its stability. I have communicated with him frequently about it, and altogether the consequence has been so strong an impression upon my mind of the *vast* and *immeasurable superiority* of the principle on which it is built, over anything that has hitherto been attempted, that I have been led into this somewhat extraordinary intrusion upon your Lordship, on a matter with which, I may be, I own, justly considered to have no very intimate or scientific acquaintance; such, however, is the *simplicity* of the work, that I will not hesitate to attempt some account and explanation of it, in the hope of drawing your attention in the first instance, which if I accomplish, you will be led I think, to give it a closer examination, which will produce eventually as strong a conviction in its favour on your mind, as it has produced upon mine.

Mr. Dredge's statements of the superiority of the power of his system over the established plan of structure certainly at first astonished me; he has however *proved* by *trials* in the presence of very many persons, a superiority of strength to the extent of at least *one hundred and fifty per cent.* These were made upon small models of bridges formed severally *on the present* and on his *new* principles, each out of the same quantity of iron. But Mr. D. carries his calculations of the accumulating power derivable from size and extent over and above the one hundred and fifty per cent. shown upon the small models, to such a degree that I will not venture to state it, but if he should be called upon in the way I trust sooner or later he will be, to exhibit his system before your Lordship and the public, he is confident he can *mathematically* and *practically* establish any of the statements he may make, and I have little doubt he will be found to be correct. He insists on the possibility of reconstructing the *iron work* of the Menai bridge at a *less* sum than the *superfluous iron* would *sell for*—so much less is *requisite*, than was *there* used; and he pledges himself to the power of the bridge, if the irons are altogether altered and reconstructed on his principle to be *capable* of supporting on transit 1000 tons. The Menai bridge is believed to have cost near £150,000 and to have consumed in its construction above *two thousand tons of iron*, and to be declared only capable of sustaining 733 tons on transit. Before I submit to your Lordship a detail of some practical experiments Mr. Dredge has made justificatory of the declarations he thus ventures to put forth, I will endeavour to give some explanation, imperfect though I am sensible it must be, of the fundamental principle upon which his mighty fabric is erected. I must give it merely as it has struck my unlearned common sense, and which it has from *its simplicity*, with a force so irresistible that it makes me believe I fully understand it. * * * * * *I conceive the grand foundation may be said to be the rendering the chains strongest* and *indeed very much the strongest at the base, tapering them by regular degrees to the centre*, where they *come at last in fact to a cipher*, from the cipher *commence* therefore their *size*, *weight*, and *strength*, which regularly *increase by degrees* quite *up to its base*, which base you know in a suspension bridge is the towers of masonry on which the chains are hung; in truth it is the application of that *principle horizontally*, which is so obviously necessary in all *perpendicular* erections, of superior size and strength at the base, and *tapering* away to a cipher on its ultimate summit;—as, for example, the obelisk, the pyramid, the church spire; and which principle he shows to be as effective *horizontally* applied, as it is in the *perpendicular*, indeed it may be said to be *far more effective*, as it has to support in so difficult a position, comparatively with the *perpendicular* its own intrinsic weight, and a heavy transit load besides. * * * * * Mr. Dredge's bridge may be well imagined by supposing a church spire laid horizontally, and met by another of equal dimensions at the point.

* For a letter from Mr. Dredge himself, see Mec. vol. xxx, p. 53.

There is another figure by which the principle may be more clearly shown, it is the *bracket*; every body knows that the bracket tapering from its base will bear horizontally a great weight, but if it was the same size from the base to its extremity, though it might continue to be called a bracket, it would hardly sustain itself if it was any considerable length.* I have to remark now upon another most important peculiarity in Mr. Dredge's bridge, and that is the *diagonal* direction of the *road suspending rods*, instead of *perpendicular*, and forming therefore, as it unquestionably does, a powerful contributary effect to the support of the whole, and this is also most easily capable of direct practical proof. There is still a further point of difference and advantage in Mr. Dredge's bridge, which appears to me equally *simple* and as *proveable*, and which also essentially contributes to increase its aggregate power and security; that is, its *horizontal action* or *pressure* which is also made obvious by a simple and familiar figure representing one-half of a bridge; suppose a straight rod of any given length, fasten a cord at one end of it and thence to the top of a wall, place the other end to that at which the cord or chain is fastened, against the wall, at such a distance below the top of the wall as will render the position of the rod horizontal, and it must be plainly seen that the rod is supported as well by its *compression* against the wall at one end, as by its cord of suspension at the other. Thus every component part of the structure is brought harmoniously to work and in perfect unity of action towards the grand object.

I will now advert again to the Menai bridge and show further in essential points the difference between that, and indeed most other suspension bridges, and Mr. Dredge's. The actual intrinsic strain at the centre of the Menai bridge, according to *Drewry, page* 167, amounts to 1878 tons, and at each extremity, 1943 tons, this vast intrinsic weight operates its own destruction, increasing its self destructive power as it increases in length; thus it becomes vibratory, and upon a gale of wind blowing upon its broadside, it has a swing or pendulous motion; this I have felt myself in passing it, the wind blowing strong at the time.

On the other hand as I have observed before, upon Mr. Dredge's principle, the *strain* and *weight* only *commence* at the centre, *increasing* as the *strength* of the bridge *increases* up to the base, and of course its ability to sustain it; this difference between these two systems may be readily imagined, by supposing a ton of iron formed into a bar of equal dimensions from one end to the other, and fixed into a wall; it will hardly support itself, still less any additional load; if extended to any considerable length it will *not* support itself; on the other hand make the same weight of iron into a taper form, and it will support its own weight to any extent, and a heavy *extrinsic* weight in addition. But further than this if the parallel equal sized bar is cut away by one half, it will then support itself and an *extrinsic* weight in addition. The reason is obvious—it has discharged itself of that which was altogether superfluous and therefore noxious in the extreme, being wholly *destructive* of power to carry any *extrinsic* weight. In this figure is a singularly accurate exemplification of the vice of the Menai bridge, and others built upon the same principle, and the obvious good sense of Mr. Dredge's. Thus his genius has led him by the *simplicity* and *perspicuity* of his conceptions to effect a discovery which I firmly *believe* will turn out of great national importance, the recognition of which by the country will I am sure be felt by him as the highest possible reward.

Having thus endeavoured to show the simple principle on which Mr. Dredge's system is founded, I proceed to give you some account of some experiments he has made, practically substantiating the truth of it, prefacing them however with a brief description of the expence and particulars of the Victoria bridge across the Avon, built in 1836, and which has proved itself equal to its inventor's most sanguine expectations. Its cost was 1650*l*., its span is 150 feet, and only 21 tons of iron were consumed in its construction, which at 20*l*. per ton is only 420*l*.; the great expence therefore was on the masonry and the timbers supporting the platform or road, which are still of insufficient dimensions and strength, but which of course are quite unconnected with the principle on which the bridge is built; the chains are under 10 tons and are equal to sustain 500 tons on transit. In November he began putting the chains of this bridge together, and in the following month it was open for general use; its road is stoned like common roads. In further proof of the correctness of this system tests have been made before various parties at various times, viz., at Bath, Jan. 2, 1838, before Messrs. Worsams from

* It may be remarked that there is not a strict similarity between the common bracket and the bridge, inasmuch as the platform or *horizontal* line is in the former, *above*, and in the latter, *below*: there is, however, no real *difference*. The power of the bracket is compounded of *suspension* and *compression*, that is, *suspension* from the fulcrum, and *compression* against the fulcrum. In the case of the common bracket, the *horizontal* line which is uppermost, being fixed or fastened securely to the fulcrum, performs the *suspension* part of the work, the arch or diagonal line below the compression, *attaching* itself to the fulcrum without fastening, the case of the bridge is however, only *so far* different, that the *arched line* does the *suspension* part, and the *horizontal* the *compression*.

London, Ball, Cambridge, and others of Bath, with models whose *lengths*, *deflections*, and *weight were equal*, the chains of each model between the fulcrums were only 9 oz. of wire, their spans were 4 feet 6 inches, their deflections 6 inches, and their platforms were 2 feet. The parallel chain model (old system) broke down on putting 6 sacks of beans on its platform weighing about 13 cwt.; the taper chain model (new system) bore the 6 sacks of beans, 7 sacks of malt weighing 10 cwt., 2 cwt. of iron and 11 men at the same time, all of which did not break it down. In Bristol, Jan. 6, 1838, before Messrs. Protheroe, Guppy, and others, two other models of equal material and dimensions were tried; the parallel chain model bore 1565 lbs., the taper model bore 3681 lbs. Again, in Bristol, January 10, 1838, more trials were made before Messrs. Acraman, Daniels, Hillhouse, and many other of the first merchants of Bristol, Dr. Waldren and many others of Bath, with models of equal material; the parallel chains bore 1456 lbs., the taper chains bore 3696 lbs. Another trial before the same party on the same day was made with models constructed by Mr. Cross of Bristol, unknown to Mr. Dredge, in order to prove that all was fair in the former trials; and the result was, the parallel chains bore 2632 lbs., and the taper chains bore 6849 lbs., each model broke on adding more weight, and the wire throughout on the taper principle was reduced one size by the experiments.

Now, my Lord, all I request is, in the event of further repairs or improvements being about to be undertaken of the Menai bridge, that you will allow Mr. Dredge to exhibit some similar experiments before your Lordship, or the Treasury, or before the Bridge Commissioners, and in the presence of any of the most eminent engineers you may choose to summon; finally, my Lord, Mr. Dredge declares that such is his thorough conviction of the truth of his theory and its facility of execution, that he would gladly undertake, at his own expense and risk the *whole of the iron work*, if he should be allowed to re-construct it, which he believes he could do, the bridge standing all the time, and that it should be competent to sustain 1000 tons on transit; the superfluous iron of the present bridge he is pretty confident would pay him and give a balance in favour of government.

Questions may after all fairly be put to me to learn why with all these advantages of Mr. Dredge's system, exhibited with so much apparent fairness, has not his principle been *at once generally* acted upon? Why has he not been called upon in many cases to execute what he thus promises? Why, if he can build the proposed Clifton bridge as he says he could for one third or less than Mr. Brunel's estimate, is he not called upon to do so? One good reason is obvious: a prudent caution on the part of the public disinclines them to overthrow long established systems, and to oppose or even question the judgment of long known and respected authorities; this feeling operates very naturally and happily in philosophy as well as in politics, but it should not in either be carried to the extent of checking the progress of improvement by well considered means; too great a tenacity for old systems may exist in the minds of many persons, though their motives may be good and their minds not illiberal; Mr. Dredge's principle of suspension bridge building completely overthrows the theory and practice of a Telford, a Brunel, whose experience and talents we are bound highly to respect, and to whose genius I readily offer the humble tribute of my admiration. Can we then be surprised that the public should evince some fear and some reluctance hastily to adopt Mr. Dredge's novel principle or theory, in substitution of that which has been so long acted upon? They ought therefore to pause, they ought to enquire, if there are any persons about to direct the construction of other suspension bridges; it is a duty they owe to those for whom they may be acting, to examine fully into the merits of a novel system which *promises fairly* such advantages, before they determine to persist in the further adoption of the present, of the correctness of which the state of the Menai bridge and the vast expenditure it occasions may well create a doubt, independent of the obviously faulty principles on which it is, I think clearly shown to be constructed. No human being was ever exempt from error, and Messrs. Telford, Brunel, and others, must not be considered to be infallible. I have only to add, my dear Lord, that in making this address to you, I have no other motive than the desire of assisting to bring forward genius, and secure for the country the benefit of a most valuable discovery and work of art, which appears to me for want of that encouragement which I think it merits, is in danger, like very many others, of being lost sight of altogether.

I have the honour to be,
My dear Lord,
Your faithful and obedient servant,
WESTERN.

To the Viscount Melbourne.

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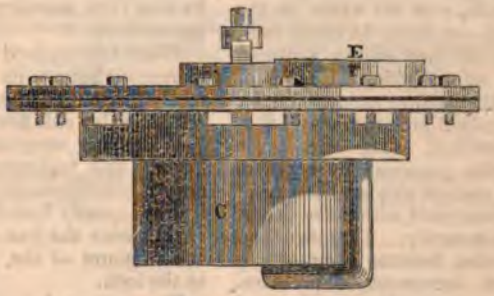
MR. H. R. ABRAHAM'S PATENT SAFETY AND WARNING VALVE.

Fig. 1



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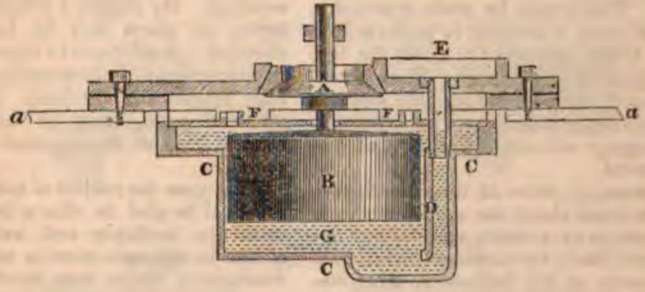

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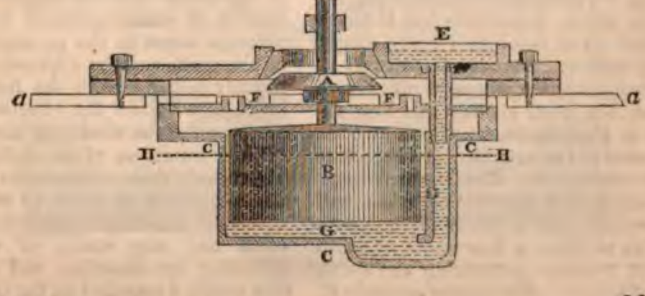


MR. H. R. ABRAHAM'S PATENT SAFETY AND WARNING VALVE — GAUGE COCK AND STOP COCK.

Sir,—The boiler of the *Cyclops* steam frigate was reported lately in the public prints to be a sufferer from collapses. I am not aware whether in this instance a valve had been provided for such a contingency, or whether the inaction of means relied upon as effectual preventives of collapse, was the cause of the mischief which occurred. In either case, however, by the use of my sensitive warning and safety valve, accidents of this, or any other nature incidental upon internal or external pressure, may effectually be prevented. The advantages which my valve possesses over others which I have seen in use, are these:

That it is contained within the boiler. That it opens inwardly. That its action cannot be sudden, because it commences with the first increment of pressure. That it cannot strike because it need never be in actual contact with its seat. That it has no vibratory or dangerous reciprocating motion as in the common valve. That it may be made to sound a whistle, close a damper, or perform any other action necessary to arrest the too rapid generation of steam. That it can be placed entirely beyond the control of subordinate hands, and be regulated for a voyage without a possibility of derangement.

A warning valve of this description may be made about the size of a ship's compass, or as a safety valve of any dimension, due to the power of the furnace, or capacity of the boiler. A short description will suffice to show the efficacy of the machine.

Fig. 1 is an exterior view; fig. 2 a sectional view before the steam is generated, and fig. 3 a sectional view, showing the valve in action. A cast iron box C forms a receiver for an iron-cased leaden weight B, and sufficient mercury G, to cover it. This receiver has a communication with another but more shallow cast iron receiver E, fixed so many inches above the lower one, as the required pressure may render necessary. The lower receiver C is suspended within the boiler, and is provided with a cover F, so contrived as to allow a free communication for steam without permitting any overflow of mercury. The upper receiver E outside the boiler, and has a communication with the atmosphere, but is suitably covered. Affixed to the weight B, which floats in the mercury, is a spindle and valve A, which acts in vertical guides, and closes against a seat in the top plate E, which is cast in one with the upper receiver, and which is screwed down to the top of the boiler *a, a*.

When there is no pressure of steam, the weight is floated, and the valve takes its seat; the mercury is then level, as shown in fig. 2.

When the required pressure is on, the mercury changes its position, and is partly discharged into the upper receiver, but the valve still floats.

When any surplus pressure occurs beyond this registered point, the mercury is insufficient to float the valve, and it drops quietly from its seat. In fig. 3, H H shows the line of mercury when the pressure of the steam is at 5lbs. to the inch.

The pressure being relieved it is again floated, and the valve is closed. By attaching the spindle to a crank upon the damper, it may open or close it as required. By placing a whistle over the orifice an alarm may be immediately sounded. A reference to the engravings in connection with these explanations will fully explain the machine. The communicating tube may be regulated to form a head of any required degree of pressure.

While upon the subject of safety-valves, I should be glad to offer a few remarks upon the inefficacy and awkwardness of the instruments now in use for the detection of danger from insufficiency or overcharge of water, I allude to the common gauge cocks and stop cocks *fixed* (as we may well say) on boilers. These are either set fast, or leaking fast. In the former case the engineer declines the risk of scalding himself by the low-pressure steam in the protracted action of the cock, and the alternative of continually easing it. In the latter case of leakage he applies the effectual remedy of screwing the cone into the first described condition of its sticking place. To remedy these evils and to insure to the engineer at all times an easy and an agreeable monitor, I designed the gauge cocks and stop cocks, of which the following are sketches, and of a pattern which I supplied to the Grand Junction Railway Company.

Fig. 4

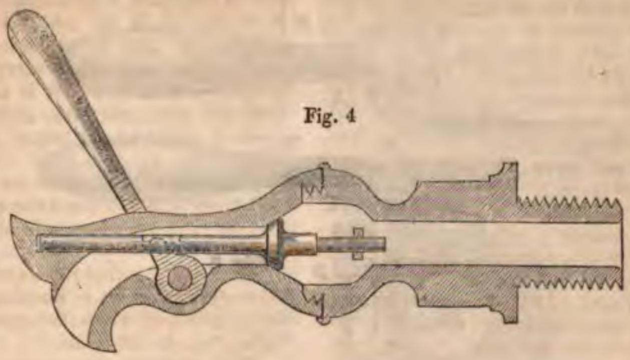


Fig. 4 is a section of gauge tap.
Fig. 5, elevation of ditto.

Fig. 6, section of stop cock.
Fig. 7, elevation of ditto.

Fig. 5

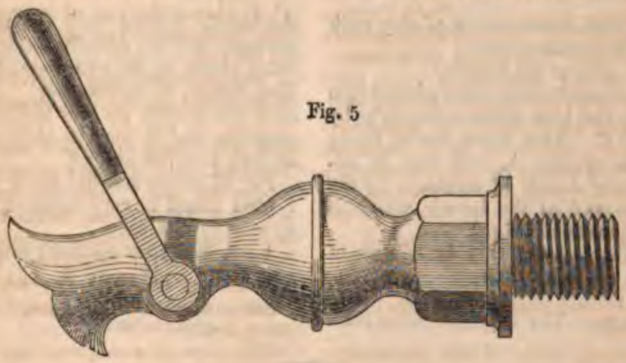


Fig. 6.

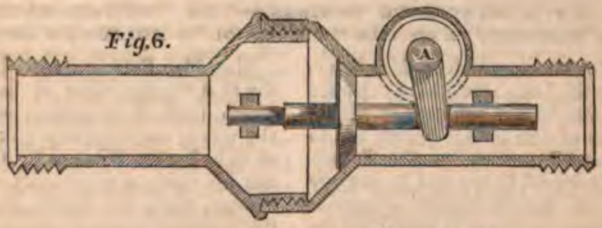
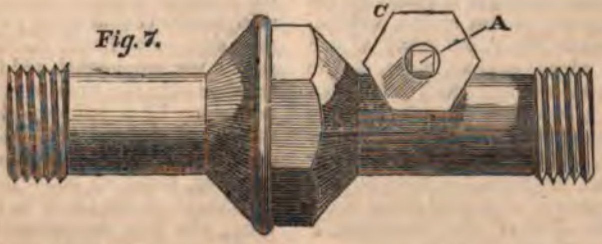


Fig. 7.



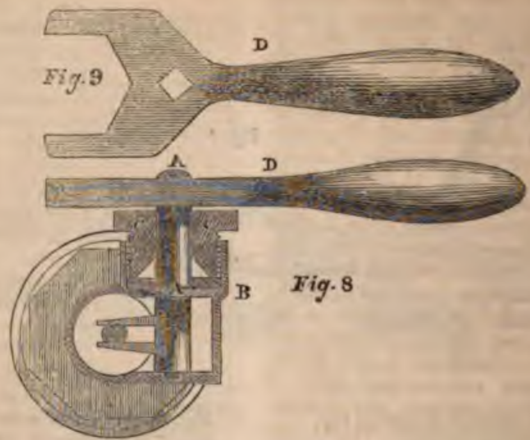


Fig. 8, transverse section of stop cock through the stuffing box.

Fig. 9, plan of the handle.

A is the spindle with valve ground into its bed B, and kept down water-tight by the screw C. This screw works freely round the spindle A, and may be adjusted to any degree of tightness by the key at the end of the handle, which is shown separately in fig. 9.

The advantages of this description of stop cock are briefly these:

It can neither leak nor slack under any pressure. The engineer turns back the handle, detects both the amount of pressure and the quantity of water; the valve closes as he withdraws his hand. The action is momentary. The stop cock will neither set nor leak under any pressure, and it may be made from half an inch to 3 feet service.

For all steam and hot-water purposes, I have found it very valuable, and can recommend its use.

I am, Sir, your obedient servant,

HENRY R. ABRAHAM.

Torrington-street, Russell-square,
April 14, 1840.

LONDON AND COUNTRY-MADE ENGINES—THE "BRITISH QUEEN," THE "GREAT WESTERN," AND THE "LIVERPOOL"—MR. HALL'S CONDENSERS.

Sir,—Your correspondent, Mr. Peterson, (page 683) can hardly have expected a full answer to his question, "Where the engines of the *British Queen* are to be matched?" seeing, (as the French say) that it would be too bad to occupy the pages of the *Mechanics' Magazine* with the long catalogue it would be requisite to give. It may suffice, perhaps, to point out to Mr. P. the name of one vessel in whose engines those of the *British Queen* will find much *more* than their match, especially since she happens to be engaged in the very same trade as the *Queen*, and the comparison of their merits is all, therefore, the more easy. I allude (I may say *of course*) to the Great *Western*, the first of the transatlantic steamers in speed as well as in date.

Has Mr. Peterson entirely forgotten the first voyage home of the *Queen*, in which, with all advantages on her side, she was at once outstripped and left out of sight by the *Western?* Or does he rest his claim to superiority on the third voyage, when the *Queen*, after exciting the anxious fears of all parties concerned, safely reached her destined port in *twenty-four days—very* nearly double the usual run of her competitor, and no less than *ten days* over the time in which it has been done by a sailing-packet, without the aid of steam at all! Miserable, indeed, were the prospects of Atlantic steaming, could no better performances than those of the Queen be relied upon. Why, she has disappointed the mercantile world on every voyage since she

has been a-float, by lagging behind her time; though justice compels the avowal that the delay has not exceeded a week more than once, out of *four* voyages! Even the "crack passage," on which so much stress is laid, as demonstrating the supremacy of the *Queen*, was a passage of this order, occupying (vide Mr. Peterson's log, page 685) upwards of fifteen days from New York to Portsmouth; and on the strength of this *wonderful* performance we are called upon to place the *British Queen* above the *Great Western*, a vessel which has, not once, but repeatedly, run from New York to Bristol in twelve days and a-half. This is the first voyage, too, since the complete and expensive over-hauling of the *Queen*, which it seems she required after no more than three voyages, notwithstanding the boasted "strength" of her machinery. The truth must be that Mr. Peterson, when he requested to be shown "Where the engines of the *Queen* could be matched?" had intended to add, "*at the price*"—without this addition, his astounding query "comes tardy off indeed."

It seems rather singular that there should exist in some quarters, so great a disinclination to admit the evident and easily accounted for superiority of London engineers, and "town-made" engines. While London remains the greatest mart for steam-machinery, and while the reputation of her engineers enables them to command the highest prices, the first-rate workmen in each department will, in obedience to every law of supply and demand, flock to the metropolis, and other places *must* put up with inferior talent and inferior prices. But transatlantic steamers require machinery of the very highest quality, and it is, therefore, false economy for any company in that trade to resort to Glasgow or Liverpool for engines, for the sake of that *apparent* saving at the outset, which is sure to prove a *real* loss in the end. The *British Queen* commenced her career under the fairest auspices; unbounded popularity greeted her first appearance, and seemed to wait on her every movement;—but, alas, she was sent (away from London!) to Glasgow for her engines, and the natural result ensued: she was delayed in her starting for several months, and she has been acquiring the character of a slow-going vessel ever since she has been a-float. And how have the company profited by experience? They have dispatched the *President* for her machinery, not to Glasgow, but to Liverpool, a port which enjoys the unenviable reputation of having fitted out the only steamer which ever exceeded the "long" performance of the *British Queen*. The latter indeed took twenty-four days to reach England from America;—but the *Liverpool* started for America, and never reached it at all, having been obliged to put back again to her native port. Could this be the reason for which Liverpool was selected, or was it merely for the sake of enjoying a repetition of the delay experienced at Glasgow, (and likely enough to be encountered at any of the outports)—which delay it seems the *President* must submit to (vide *Mechanics' Magazine*, page 544) for "the want of proper shears to hoist in the machinery and boilers!" The *saving* ought indeed to be great to counterbalance the disadvantages attendant on sending a vessel away from the very place in which she could be not only most excellently, but most quickly and conveniently fitted with her machinery, to another, like Liverpool, where first-rate workmanship can hardly be expected, and the accessories requisite for dispatch are wanting to an almost incredible degree.

To return to Mr. Peterson, it must be admitted that his log shows a very high vacuum attained by the use of Mr. Hall's condensers; but, allowing all that Mr. P. observes as to the average vacuum in sea-going injection engines to be quite correct, what are we to think of the machinery of the *British Queen* in other respects, when, *with a vacuum secured of 30½ inches, no deposit in the boilers, &c.*, she is beaten regularly by vessels supplied only with injection-condensers, making a vacuum of only 27½, with furred boilers, and all the other drawbacks? Is it not reasonable to conclude that the engineers of the Thames must be *vastly* superior to those of the Clyde, when such are the consequences?

There is a discrepancy between the body of Mr. Peterson's communication, and the log accompanying it, which is not easily reconcileable. In the former he observes "Bedwell's Patent Barometer shows 30½ inches; others and myself have seen it even higher than this, although 30½ inches was the mean on the last passage home." Yet the detailed extract from the log gives 30¼ inches on

five days only, and, on the remaining *ten* days, numbers invariably less than 30¼. How then is the "mean" of 30¼ arrived at? It is hardly perhaps worthy of remark, (as *this* may be explained) that the certificate to the effect that the subscribers had "witnessed the mercury standing *steadily* at 30¼ inches," is dated on the 13th of April, on which day it appears from the log that 30¾ was the height attained, while 30¼ is not registered for five days previously. The "steadiness" could not have been very great, if the date of the document be intended to have any reference to the date of the event certified in it.

In concluding for the present, permit me to express a hope that Mr. Peterson and other parties connected with the *British Queen*, will for the future be a little more chary of attributing interested motives to each and every antagonist. I perceive that this system is not confined to the pages of the *Mechanics' Magazine*, but that wherever the *Queen* is attacked, the same ammunition is made use of—probably for want of better.

And, I am, Sir,

Very respectfully, yours,

OBSERVATOR.

London, May 7, 1840.

THE CONDENSING PERFORMANCES OF THE "BRITISH QUEEN."

Sir,—It is proper it should be known in answer to Mr. Peterson's maiden production of last week, that it is only when the engines of the *British Queen* are working with Hall's condensers that the vacuum is tested by Bedwell's short barometer. When the engines are working by injection the vacuum is tested by a long barometer and then indicates only 27 inches of mercury. To account for this, by saying that the engines are made in Scotland is very absurd—for if there is any credit at all in the case, it must be due either to Hall's condensers or Bedwell's barometer. Now to show that there is little due to both these last instruments, allow me to request a place for the following remarks:—

When engines are working by injection the condensers are, in their interior, one undivided space, and, consequently, the vacillation of the vacuum is felt throughout the whole condenser twice during *each stroke*. It is for this reason, that *when a long* barometer is attached to the ordinary condenser, by a moderately large tube, say ¾ths, and when the stop cock is full open, every time that the steam discharges itself from the cylinder of the engine, a fall of the mercury is observed, and the continuance of this action causes a regular fluctuation in the mercury, which can only be made to exhibit an uniform height by nearly shutting the cock. Such of your readers as are not in the habit of seeing this for themselves may refer to the standard work on the Steam Engine by Mr. Farey, page 378. Now in Mr. Hall's condensers the space is sub-divided by the tube in the very highest degree. The consequence is, that the vacuum does not spread itself equally throughout the whole interior, but will vacillate most at the place where the steam enters from the cylinder and be most steady at some obscure corner, where it is undisturbed. Now we believe, that even if Bedwell's barometer were attached to Hall's condensers in the *British Queen* at the afore-mentioned place, a much greater fluctuation would be indicated than in the ordinary condenser; and that when placed, as it is at the back end of the tubes, it is enabled to indicate a perfection of vacuum which is vainly and improperly ascribed to the whole space. It is obvious, that the power of the engines must be less on this account, not more. And I trust that Mr. Peterson, whose motives are so disinterested, will allow his friends an opportunity on his return, of ascertaining how many of the 30¼ inches of mercury he is enabled to convey to the pistons by placing a McNaught's indicator on the cylinder cover. The impression left, certainly is, that for the reasons before-mentioned the engines will be found to show a better vacuum on the piston with the common condensers than by Hall's patent; so that the conclusion is rather in favour of Scotch engines—than otherwise.

Now as to the share which Bedwell's barometer may have in this seeming superiority, I have heard it stated by one of the engineers of the *British Queen*, that the mercury in that instrument actually descended below its own level in the bason. Now this shows that there cannot be a Torricellian vacuum in the upper part of the small tube, and we know, that if that is once disturbed by the admission of vapour, it cannot afterwards be restored without an infinitude

of trouble. Such is not the case with that friend of truth, the long gauge, because every exhalation of vapour, which may confidently be expected from an instrument so placed, is continually drafted off into the condenser, and dissipated. What weight these last arguments against the use of Bedwell's barometer in general, may have in the case of those in the *British Queen*, will be seen on her return, but it is to be wished that both condensers could be subjected to the test of one gauge, in order to determine their relative merits.

I would only remark further on the folly and vanity of supposing it possible to obtain a vacuum purer than the Torrecellian vacuum with an instrument so rough as an engine air pump, when we know that there must always be a medium behind the valves of any air pump sufficient by its elasticity to open them, thus establishing a limit to all machine vacuum, and a pretty close one to those of steam engines. Mean time,

I remain yours respectfully,

"TOM, DICK OR HARRY, A. B. OR C."

May 7, 1840.

MR. OSLER, AND THE RIVAL MANUFACTURERS OF MERCURIAL LETTER BALANCES.

Sir,—When writing the description of Sir John Robison's Mercurial Letter Balance, which appeared in your 869th number, (page 488), I took occasion to make some strong remarks upon the conduct of Mr. Osler, the registered inventor of a similar instrument, with reference to a supposed attempt on his part to exact a "*royalty*" from the Scotch manufacturers, under pretence of granting licenses, by virtue of his registration.

I have just received a communication from Mr. Osler, in which he complains of these remarks; Mr. Osler writes as follows:—"With regard to the letter balance registered by me on the 12th December last, I had neither seen nor heard of anything of the kind then, nor until some time afterwards. In the course of December I learnt that Mr. Lund, of Fleet-street, was making a letter balance,* the action of which was entirely different from mine; however, I did not see it till the 10th April following. On the first of January I was informed that a mercurial letter balance was being manufactured in Edinburgh; this intelligence was communicated to me by my friend Mr. Frederick Hill, the inspector of prisons for Scotland, who had purchased one. I did not, however, see it, on account of its being packed up with Mr. Hill's luggage. I subsequently received a letter from Sir John Robison, dated Feb. 22nd, with reference to my having interfered through a third party with the manufacturing of an instrument of his invention, and which it appears was the same as the one purchased by Mr. Hill; being perfectly ignorant of the whole circumstance, I of course denied being a party to any such transaction, in a letter to that gentleman, and *I can truly again most unequivocally state, that I have neither directly nor indirectly threatened, or ever found fault with any one, for manufacturing any such instrument.* I cannot conclude without adding that every part of the details of my plan was strictly original with myself, except the floating ring, which was an improvement suggested by my brother-in-law, and that was quite original with him."

From Mr. Osler's explanation, therefore, it evident that he has been the victim of a base attempt on the part of some dishonest person to extort money by using Mr. Osler's name,—which besides proving a source of considerable annoyance to the party attempted to be thus defrauded, has given Mr. Osler's conduct an appearance of illiberality, which is, in reality, wholly undeserved.

With reference to the Editorial note, at page 489, commenting on the improper assumption of the word "*Patent*," Mr. Osler says, "I can merely plead the custom of trade to assume the use of this word in such cases." I am aware the custom of the *Birmingham trade* has been very lax in this matter, but if I mistake not, this custom was abrogated by Lord Brougham's Act, in which I believe the application of the term to *unpatented* articles was prohibited, under penalties.*

I feel that it is due to Mr. Osler, to request an insertion of this explanation in your next number, which will oblige

Yours respectfully,

WM. BADDELEY.

May 8th, 1840.

* The invention of John Taylor, Esq. W. B.

* There is a clause in the Act to this effect. ED. M. M.

EXPERIMENTS UPON THE NEWCASTLE-UPON-TYNE AND NORTH SHIELDS RAILWAY, WITH TWO LOCOMOTIVE ENGINES, THE "COLLINGWOOD" AND "EXMOUTH," AS TO THEIR RESPECTIVE CONSUMPTION OF COKE AND WATER.

Note.—The "Collingwood" was manufactured by Messrs. R. Stephenson and Co.; and the "Exmouth" by Messrs. R. and W. Hawthorn; the latter being on an improved plan, for which they have recently taken a patent. The experiments were conducted under the superintendence of Mr. R. Nicholson, the engineer of the railway. The first-class carriages weighed 4½ tons; second-class carriages 4 tons; trucks 2¼ tons; the passengers, including luggage and parcels, may be estimated at 12 to a ton.

THE "COLLINGWOOD."

Trials.	Date.	Number of Trips.	Distance travelled.	Mean Rate of Speed.	Coke consumed.	Water evaporated.	Load, including 5 Tons for Tender.	Observations.
	1840.		Miles.	Miles per Hour	Cwt. qr. lbs.	Gallons.	Tons.	N. B.—The Line of Railway runs nearly East and West.
1	April 2nd	12	84	30	23 3 26	2178	39·21	Fair, with moderate North East Wind.
2	4th	14	98	30	29 2 25	3180	50·07	Fair, with strong North West Wind.
3	5th	10	70	30	24 0 26	2097	51·29	Fair, with strong North West Wind.
4	7th	14	98	30	31 0 25	2978	34·32	Showers, with strong Wind from North East.
5	8th	12	84	30	26 3 26	2330	36·72	Showers, with strong Wind from North East.
6	9th	14	98	30	29 2 25	2763	36·97	Fair, with moderate South East Wind.
7	11th	12	84	30	29 3 26	2480	51·04	Showers, with strong South West Wind.
8	13th	14	98	30	35 2 25	3044	38·16	Fair, with moderate South East Wind.
9	14th	12	84	30	26 3 26	2355	39·54	Fair, with moderate South East Wind.
			798		258 2 6	23405	377·32	

$$\frac{798}{9} \times 377.32 = 33455 \text{ tons conveyed one mile.}$$

Cwts. qr. lb.
258 2 6 = 28958 lbs. of coke.

Gallons.
23405 = 234050 lbs. of water.

$$\text{Hence } \frac{28958}{33455} = .8655 \text{ lbs. of coke per ton per mile.}$$

$$\text{And } \frac{234050}{33455} = 6.996 \text{ lbs. of water per ton per mile.}$$

Outline of Dimensions.

Boiler.—8 feet 5 inches long, 3 feet 6½ inches diameter, with 111 tubes 8 feet 9 inches long, 2¼ inches diameter outside.

Fire Box.—Length, 3 feet 4 inches; width, 3 feet 4½ inches; height above the grate bars, 3 feet 9 inches.

Cylinders.—Diameter, 14 inches; stroke, 18 inches.

Wheels.—4 wheels coupled, 4 feet 9 inches diameter; and 2 carrying wheels, 3½ feet diameter.

THE "EXMOUTH."

Trials.	Date.	Number of Trips.	Distance travelled.	Mean Rate of Speed.	Coke consumed.			Water evaporated.	Load, including 5 Tons for Tender.	Observations.
	1840.		Miles.	Miles per Hour.	Cwt.	qr.	lbs.	Gal-lons.	Tons.	N. B.—The Line of Railway runs nearly East and West.
1	April 2nd	14	98	30	20	2	25	2314	37·46	Fair, with moderate North East Wind.
2	4th	12	84	30	19	1	26	2006	55·20	Fair, with strong North West Wind.
3	5th	10	70	30	15	0	26	1872	56·29	Fair, with strong North West Wind.
4	7th	12	84	30	22	1	26	2265	35·04	Showers, with strong Wind from North East.
5	8th	14	98	30	23	2	25	2409	36·83	Showers, with strong Wind from North East.
6	9th	12	84	30	16	1	26	1635	38·52	Fair, with moderate South East Wind.
7	11th	14	98	30	22	0	25	2551	49·74	Showers, with strong South West Wind.
8	13th	12	84	30	20	3	26	1818	39·22	Fair, with moderate South East Wind.
9	14th	14	98	30	20	2	25	2226	38·43	Fair, with moderate South East Wind.
			798		182	0	6	19096	386·73	

$$\frac{798}{9} \times 386{\cdot}73 = 34290 \text{ tons conveyed one mile.}$$

Cwt. qr. lbs.
182 0 6 = 20390 lbs of coke.

Gallons.
19096 = 190960 lbs. of water.

$$\text{Hence } \frac{20390}{34290} = {\cdot}5946 \text{ lbs. of coke per ton per mile}$$

$$\text{And } \frac{190960}{34290} = 5{\cdot}568 \text{ lbs. of water per ton per mile.}$$

Saving of fuel in the "Exmouth" over that of the "Collingwood" is 31·3 per cent., and of water 20·41 per cent.

Outline of Dimensions.

Boiler.—8 feet long, 3 feet 7½ inches in diameter, with 77 direct tubes 8 feet 4 inches long, 2¼ inches in diameter outside, 45 return tubes 11 feet 2 inches long, 2¼ inches diameter outside.

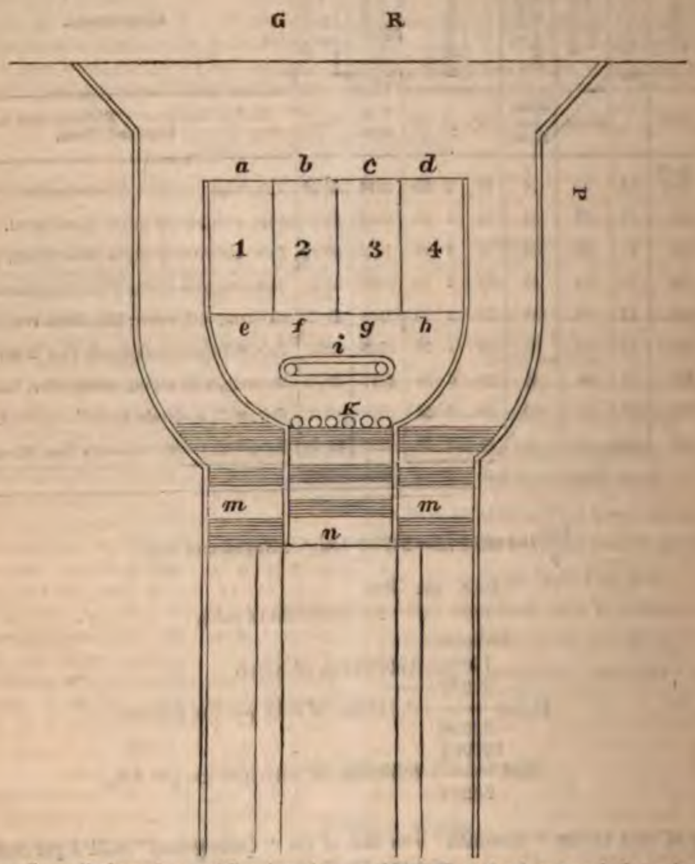
Fire Box.—Two fire boxes, 2 feet 6 inches long, by 1 feet 6½ inches wide, each, and 3 feet 9 inches high above the grate bars, arched at the roof, by which stay beams and bolts are dispensed with.

Cylinders.—Diameter, 14 inches; stroke, 18 inches.

Wheels.—4 wheels coupled, 4 feet 9 inches diameter; and 2 carrying wheels, 3½ feet diameter.

R. and W. Hawthorn.

Newcastle, May 6, 1840.



Sir,—In offering for publication in your Magazine, a few strictures upon the plan of the new terminus at Greenwich for the London and Greenwich Railway, I forward you at the same time a rough sketch of what I conceive should have been the plan of the building.

The Greenwich Railway is unlike any other railway in the country, and its wants require arrangements uncalled for upon any other line. It is necessary to provide for the accommodation of an *immense traffic* at certain intervals; it must *be made* therefore upon the principle of *expanding* to the extreme wants of the public when the busy periods arrive, and of being contracted within narrower limits upon ordinary occasions. The engineer who had in view only one of these conditions, would certainly fail in producing a work fit for the purposes of this railway.

Now it happens, unfortunately, that the parties who have been charged with the building of the terminus have made provision only for the last of these two cases. The building is well adapted for a wet day and a small traffic, but is wholly useless for all the purposes of a holiday at Easter or a fine Sunday in

summer—occasions on which the largest revenue is derived to the Company from the line. It should have been the particular object of the engineer to arrange that the public should be supplied with the utmost accommodation on such occasions, and they should have been received upon the line with every possible convenience and comfort.

The experience of the last Easter holidays but too clearly proves the utter unfitnesss of the terminus for so busy a season. It was really shocking to witness the crushing at no less than four distinct points; viz., the outside gates, the pay and turn tables, the entrance door of the waiting room, and the exit door of the same, added to which are three descending steps, from the waiting rooms to the platform. These most inconvenient steps have been rendered necessary to bring down the level of the waiting rooms to that of the platforms, the difference being occasioned by making the basement offices 18 inches too high. If this has been done for architectural effect, it is a result very dearly purchased, at the expense of the public convenience, as persons rise the same number of steps on one side of the room that they descend on the other, and for no useful purpose.

Another fault is the raised platform on each side of the shed, which makes the entrance into the carriages very much more inconvenient than upon the old plan, by the *steps* to the *low carriages*. It is not, I presume, intended by the Directors to attempt another introduction of the *high carriages* upon this line, after the most decided preference shown by the public travelling upon the line, for the *low carriages*.

Shortly after the accession to office of the present Board of Directors, allusion is made in one of their earliest reports, to the carriages of the Company, to their defective state, ill appearance, &c., and it was stated that a contract had been entered into with an eminent coach-builder to take the old carriages at a certain price, and supply new ones upon a better and handsomer construction. In due time thereafter five new carriages were supplied upon the high principle and placed upon the line, but when these carriages were arranged in trains to receive the passengers, those parties who were compelled to use them (their time forbidding that they should await the arrival of the low train) entered them with the utmost dissatisfaction, most unequivocally expressed to the superintendent and servants of the company, whilst others went away and used other conveyances. Nay, so decided was the expression of the public opinion upon the subject, that, after about a week's perseverance, the Directors gave way, and removed the high carriages from the line. Neither have they ever been used since, until the Easter holidays just past, when, together with a train of carriages on the same construction, belonging to the Croydon Company, they were employed in consequence of the stock of low carriages being insufficient, for the numerous passengers who required to be conveyed along the line.

The most judicious method upon which the ground plan of the shed could have been laid out, would have been, to have made it level throughout, without platforms, and to raise the ballasting to the level of the rails throughout. The passengers by the arrival trains would then have made their exit upon the sides next the walls, and the departure passengers have entered the same carriages upon the opposite side. Thus no time would have been lost, and it would have been unnecessary, as it is now, for the arrival passengers to be entirely cleared from the platforms before the departure passengers are admitted upon it. More than this, the swinging gate would have been dispensed with, which is now necessary, as well as a policeman to attend it, to direct the traffic alternately from the one platform to the other.

Had it been proposed to me to arrange a station for this railway, I should have done it upon the principle shown in the accompanying diagram.

The front of the building should have stood back at least 20 feet from the road, (G R) so that the public thoroughfare should not have been discommoded, nor the passengers subjected to danger from being driven by the crowd into the road on any occasion. A considerable roofed area should have been divided into partitions, say four, each capable of containing about 200 people, (the load for a train.) Each of these should have had an entrance and exit gate at least 12 feet wide. These divisions are numbered 1, 2, 3, 4, the entrance gates a, b, c, d, and

the exit gates *e, f, g, h*. The pay tables are supposed to be placed on all sides of the oblong figure *i* in the middle of the hall, and the six turn-stiles K, at the foot of the stairs, *n*. The exit stairs are on both sides of the main staircase, with a passage at *m*, communicating with both lines, so that passengers could pass to the north or south. The first-class passengers might pass through the outside turn-stiles, where there would be less pressure from the crowd, and would pass to the room appropriated to their use, or to the line at once, as the case might be.

The mode of operation would be as follows:—The public would be admitted into No. 1—the exit gate being closed until it was full. The entrance gate *a*, would then be closed, the entrance gate *b* opened, and the passengers would enter No. 2, whilst the passengers in No. 1, were passing into the Hall and to the pay-tables, and from thence through the turn-stiles to the line. As soon as No. 2 wss full the gate *b* would be closed, and the passengers pass into No. 3, and successively into No. 4, and so on.

The principle consists in dealing with a current of people in the same way as a current of water, to cause it to flow through a channel gradually enlarging towards its mouth, and if it must be checked or sub-divided, that the check or sub-division should be made at the source and not at the mouth of the stream. Instead of attempting to stem the column at a point where you have the entire weight of the column to contend with, we ought to apply ourselves to that point where you have to deal with particles after particles, and not with the mass.

This plan is the only one by which multitudes can be received upon a railway without confusion, or injury to themselves, and, its application is exceedingly simple. Four attendants, would with ease, do the whole duty of admitting the people, and would manage the whole proceeding with as much precision as if it were a piece of mechanism, and with comfort, not only to themselves but to the public.

It is perhaps useless to observe that the preceding observations apply to busy *seasons only*, and that for ordinary *occasions the* entrance doors might be left *open, and* the public allowed to pass to the pay-table at once; in which case instead of six, two or even one turnstile would be all that is necessary; and waiting-rooms, for the different classes of passengers, might be arranged as found most convenient.

I am, Sir, your obedient servant,

W. J. Curtis.

15, Stamford-street, Blackfriars.

COOKING BY GAS.

Sir,—I have read the articles referred to (p. 442) respecting Mr. Hicks's Gas Cooking Apparatus, but from my ignorance of the patent laws, am not able to form an opinion of what is, or what is not, an infringement on Mr. Hicks's patent. I should be obliged to any of your readers who would inform me if Mr. Sharp of Northampton still continues to make gas cooking apparatus; if any legal proceedings have been taken as threatened by Mr. Beale: and also if gas cooking apparatus' is made by other parties. I have heard that the apparatus is made in London, by manufacturers without any licence from the proprietors of Mr. Hicks's patent. Authentic answers to these questions will furnish presumptive evidence one way or the other, I am not interested in the *manufacture* of the gas cooking apparatus, though as a shareholder in a gas company and consumer of gas I am anxious to see it brought into general use, being satisfied of its immense benefit to gas companies.

In the discussion relating to cooking by gas in vol. xxiv. of the Magazine, I see the name of Mr. John Barlow, who appeared very sanguine as to its being brought into general use. The house of Messrs. Barlow and Co. have erected many gas works in various parts of the country, but in none of these places have I heard of the plans, for cooking being used. I know towns that have been lighted with gas for 20 years and yet cooking by gas is unknown to them. I had read and heard of cooking by gas, and seen sketches of some of the apparatus', from which I was induced to send for one to try its merits; this I found expensive in its first cost, expensive in its operation, and inconvenient in form. I forbear to mention the manufacturer, as I should be sorry to injure any one. All the contrivances I have seen cost from 4*l*. to 7*l*., while mine can be made for about 30*s*., not including boilers and tea-kettle, and it is amply sufficient for my purpose, and has been very highly approved of by all who have seen it; so much so, that I would engage we should have twenty in operation in a few weeks, if we could only get them made at a reasonable

price; and once in operation, I am satisfied they would always remain so.

Of late years gas has been introduced into many small towns and is found to pay very well, but if the cooking apparatus were generally used, not only small towns but any little compact village would find it to their advantage to introduce gas. This would greatly benefit the manufacturers of those articles used in the construction and repairs of gas works. Were I a manufacturer of these articles I would adopt the following course. In the first place I would give a premium for the best and most economical gas cooking apparatus, (I would gladly give my humble service) and having fixed upon the best, would make a present of one, with an experimental meter to test its merits, to every gas company that I supplied with retorts, &c. and the consequence would be its increased, and in time, general adoption.

I am, Sir,

Your's respectfully,

WM. WELLER.

Battle, April 3, 1840.

Postscript.

The preceding is the substance of a letter which I wrote about a month ago, but mislaid, and other pursuits have taken off my attention from the subject, till to-day a letter in this month's magazine signed "An Occasional Reader," has revived it in my mind.

I think these London gentlemen (I presume from his letter that your correspondent is a Londoner) ought not to be too hard upon the ignorance of us country folks. We live away from the great emporium of learning, and have not the opportunity of lectures and experiments to instruct us in the various branches of science. It would be more in accordance with true Christian feeling if "An Occasional Reader" would set on foot a subscription to assist in supplying us with lectures on the subject of cooking by gas, and other important and useful subjects. Your correspondent is very eloquent in his exposure of my ignorant pretensions, but I really think he cannot have *read* my communication; if he had he surely would never have strung together such a mass of unmeaning sentences. Your correspondent charges me with *pretending to have discovered* that gas can be applied to cooking, when nearly the first words of my letter referred to Hicks's Gas Cooking Apparatus, in these terms:—"I have made some inquiries, but have *met with only one patented* article, this is by Mr. Robert Hicks," &c. Your correspondent again charges me with *pretending* to have *invented* an apparatus for cooking by *gas*. *I have pretended* to no such thing; *there is nothing about invention* in the whole of my letter, and if you, Mr. Editor, can lay your hand on a private letter I sent you, you will find these words, "It is not an invention, but simply an improvement (*if it be such*) upon what I have seen."* I have simply made an apparatus of a peculiar form, which answers uncommonly well, and appears to me to be superior to some others I have seen and used.

"Who censures pride must first himself be free."

Your correspondent has not always been quite wide awake himself. He says, "To so much perfection has the art of cooking by gas been brought by the ingenious manufacturers and vendors *(and for ought I know inventors)* of the apparatus, Messrs. Sharp and Co., of Northampton." If your correspondent will take the trouble to read the discussion on this subject in the 24th vol. of the magazine, he will find that Mr. Sharp applied for a license to manufacture and use Mr. Hicks's apparatus, but not agreeing as to terms he set to work himself and no doubt greatly improved the apparatus; but still he is only an improver and cannot be called the *inventor*. But, after all, I am obliged to your correspondent for his letter; it is an answer, in part, to the letter to which this is a postscript. The letter of your correspondent furnishes a strong presumptive evidence that we can manufacture the cooking apparatus. It is "made by Messrs. Sharp and Co., of Northampton," "by numerous copyists in various parts of the kingdom," and "long been *regularly* made and sold in many parts of the country." I have no particular partiality to the peculiar form of my own apparatus. Any other that will answer better, and is not too expensive, I should be happy to see.

Will your Dublin correspondent accept my thanks for his letter, and the sketch he has sent you? I shall call on Mr. Ricketts the first time I am in London, and examine his cooking apparatus. We want an apparatus for cooking by gas, simple in form, cheap in price, and economical in use. We want to set it a-going in various parts of the kingdom, and with such qualities it would soon come into general use.

Many have said to me, "I have no doubt but that under your superintendance the apparatus is economical, but left to the care of servants they will be extravagant in the use of the gas." This will apply to fuel of all kinds, and much more than to gas, for where economy is the order of the day, with the use of a key, the supply of gas might be regulated by the master or mistress of the house with very little trouble.

W. W.

May 2, 1840.

* We cannot lay our hands upon the private letter referred to, but perfectly remember that such was the substance of it. ED. M. M.

LAKER'S "USE OF THE SIDE-RULE"—MR. LAKER IN REPLY TO MR. WOOLLGAR.

Sir,—In No. 870 of your very valuable periodical, I find a letter from Mr. Woollgar, written with the avowed intention of making it appear that I have been guilty of injustice towards him in publishing my "Use of the Slide-Rule."

As I receive the *Mechanics' Magazine* in monthly parts, I did not see the letter referred to until the beginning of the present month. As it contains some gross misrepresentations, you will, I trust, permit the insertion of this letter in as early a number as possible, in order that the refutation may be as widely circulated as the calumny.

Mr. W. accuses me of putting forth a complete reprint of *his* "Companion to the Common Sliding-Rule," making some very slight occasional variations, and interpolating about 55 more formulæ, and having published it as my own.

Mr. Woollgar is certainly the last person from whom such a complaint might have been expected, seeing that *his tract is quite as much a reprint of the formulæ contained in Mr. Bevan's work, with very slight occasional variations, and the interpolation of about* 84 *more formulæ!* This fact he studiously conceals, and in his letter endeavours to impose his publication upon the readers of the *Mechanics' Magazine* "as his own"! The explanatory matter occupies about three pages of his tract, taking it line by line as it occurs throughout, and even for part of this he is also indebted to others.*

It will be found I have not proceeded in this manner. It was not till ten years after the publication of this tract, and long after a copy could be procured, that I was induced, from the great want of a work of the kind, to publish my "Use of the Slide-Rule," in which, following Mr. Woollgar's example, and that of every other writer on the subject, I have been considerably indebted to my predecessors—not, however, without making a proper acknowledgment of the same in an "advertisement" drawn up expressly for the purpose, and prefixed to the work. What I claim, as my own is included in the notation (amounting to about half the explanatory matter) about 55 entirely new formulæ, which, on examination I believe will not be found among the least valuable, as well as other additions, all of which Mr. W. admits "are well made," and he adds that "the users of the slide-rule are no sufferers by the circumstance of the new edition not being brought out by himself." In fact he informed me, during a personal interview, that I had considerably *exceeded* what he would have done had he again published. Another by no means unimportant distinction between his tract and mine is, that while *his* is adapted to the *common carpenter's rule only*, mine is applicable to *that as well as to the better sort of rules.* So much for Mr. W.'s assertion that it is a complete reprint.

In order to set in a proper light Mr. W.'s magnanimous forbearance from procuring an injunction from Chancery, it is only necessary to state that this forbearance was not called into play until after he had threatened me by letter with some such process, which should have the effect of stopping the sale of my work, and had found that I was not thus to be induced to make false admissions.

The paragraph next to the last of his letter is altogther unfounded. I never made such an admission; neither is there any thing in our after correspondence exhibiting a wish to defend an acknowledged fault, as I have uniformly denied having committed one.

I still maintain the point at which I set out, namely, that I have an equal right to originality in my work to what Mr. W. has in his, and an equal right to publish.

As to Mr. W.'s "butterfly" kick in the note to his effusion, I may add that it would be easy to reply in the same strain; but your space, Mr. Editor, must be far too valuable to be wasted by such remarks.

Desiring only candid examination to free myself from misrepresentation,

I remain, Sir,

Yours, &c.

JOHN LAKER, jun.

Maidstone, May 6, 1840.

* *We cannot allow so depreciatory a notice of a most valuable work to pass without entering our own entire dissent from it. We leave it, however, to its ingenious author himself to reply more particularly to Mr. Laker's very uncandid remarks.*—*ED. M. M.*

NOTE IN EXPLANATION OF THE "NEW THEORY OF THE UNIVERSE."—(P. 555.)

Sir,—I am much obliged by the insertion of my new theory of the universe, in your widely extended work. It is of great consequence that it should be recommended to the particular observation of the well informed practitioner. By the demise and decay of animal and vegetable existence, I mean that destruction of organization which reduces it to ashes in whatever manner caused; consequently, fire is included in the term, exhalation. I need scarcely point out that this represents the firmamental fluid while undergoing absorption in its original state, as the cause of cold; and in its state of exhalation as the cause of heat. The change being the result of its communication with the living

body, and most probably produced by the friction incident to life. Bacon says, that "heat and cold are nature's two hands, whereby she chiefly worketh," and if we really examine deeply, I don't think we can find any power independent of them. One simple law appears to me to carry on all the wonderful works of the Almighty, and that law to consist in the concentration and diffusion of a fluid which, in two different states, occupies all that which is commonly called space. From the chemist, the electrician, the metal refiner, the glass manufacturer, the magnetiser of the needle, and from how many others, may I not hope for a deep investigation of a theory of such very great importance to the Arts. The astronomer and physician will also find it well worthy of their deepest consideration. It may involve a very interesting question on the subject of tides. But I am unwilling further to intrude on your readers.

And remain,
Yours, &c.,
E. A. M.

May 4, 1840.

EFFECTIVE POWER OF STEAM ENGINES.

Sir,—As is often the case, the discussion between "Indicus" and myself has assumed a collateral interest, distinct from the original question, and of far more importance; being neither more nor less than the correct method of calculating the effective power of steam engines. The rule quoted by "Indicus" in your last week's number from the latest edition of Tredgold, differs so widely from that made use of by me; that it is very desirable publicity should be given, through your Magazine, to the data upon which it is based; for the benefit of such of your readers as, like me, may not have access to the work itself.

In the first place, it is necessary that I should satisfy "Indicus" as to my authority for the rule used by me. It is true I did not take it from any edition of Tredgold itself, but I found it in "Galloway's History of the Steam Engine," pp. 450. 462, where it is professedly quoted in Tredgold's own words.

I may truly say, that the formula given by "Indicus" is quite as inexplicable to me, as he states mine to have been to him: the allowance for friction, &c. is nearly the same in both, the difference between the decimals "·6," and "·536," being the additional allowance of Tredgold for using steam expansively; but the great discrepancy is, that I apply this fraction to the gross pressure in *the boiler*; whereas, "Indicus" applies it to the *net* pressure above the atmosphere—a most material difference.

I do not profess to understand the third and fourth elements in Indicus's formula. The deduction of 11.5 would seem, from its amount, to be the pressure of the atmosphere: but why it should be applied to that which is *already* net pressure, or why it should be multiplied by the fraction 4, passes my comprehension. I shall be really obliged by the explanation which no doubt accompanies the formula in the *last* edition of Tredgold.

For the sake of clearness I shall place the two formulæ in juxta position; the first being that used by me, wherein the value of ϕ is the *gross* pressure in boiler; the second, that given by Indicus, wherein the value of ϕ is the *net* pressure, or "excess in boiler above atmospheric pressure."

$$\phi \times .536 - 11.55 \times a^2 \times v.$$
$$\phi \times .6 - (11.5 \times .4) \times a^2 \times v.$$

NAUTILUS.

May 12, 1840.

NOTES AND NOTICES.

Frauds in Soap.—With regard to silica and clay soap the experiments which have been hitherto made are not sufficiently numerous to give the requisite information; but as neither the silica nor the clay contributes anything to the detergent qualities of the soap, but merely increase its weight, all such additions ought to be prohibited by Government. Suppose a pound of good soap to cost 6d., and that another soap, containing 20 per cent, of silica or clay, is sold at 4⅘d., the two will be exactly the same value, for four pounds of the good soap will go as far as five pounds of the adulterated soap. If the manufacturer charges 5d. for the pound of the adulterated article, he overreaches his customers to the extent of a farthing per pound. If this apparent cheapness have a tendency to increase the sale of soap, it operates as a premium to induce manufacturers in general to adulterate the article. The great extent to which the trade of Great Britain has reached was originally founded on the goodness of the articles manufactured; the present rage for cheapness has an universal tendency to adulterate every article exposed for sale; and, unless it is counteracted by a vigilant government, it must terminate in the destruction of the foreign trade of the country. The soap made for exportation is always of inferior quality; hence the monopoly of the French soap-makers, who supply Italy, Spain, and South America with all the soap required by those extensive countries. If silica soap be permitted to be made, it ought to be charged according to its specific gravity, allowing it to contain 20 per cent of silica, as the maker supposes it to do. Hence its specific gravity in the liquid state ought to be 1.3191. Hence a pound of it will have the bulk of 21.016 cubic inches; or it ought to pay one-fourth more duty than common yellow soap. In what is called clay soap the clay is not at all combined with the alkali, no soap is formed with it; and its action is merely mechanical; in fact it diminishes the power of the soap with which it is mixed in proportion to the quantity. The motives for mixing clay with soap are too obvious and too well understood to require any comment.—*Report of Commissioners of Excise.*

Steam Pressure Indicator and Safety Valve.—At the last meeting of the Society of Arts the gold Isis medal was awarded to Mr. Robert M'Ewen, for a mercurial gauge which answers the double purpose of an indicator of steam-pressure and a safety-valve for engine boilers. The novelty of the invention consists in the employment of a mercurial tube as a safe-vent for the steam, these tubes having hitherto been used only as indicators of pressure, and of a length sufficient to allow the steam to acquire a dangerous degree of pressure without giving any other notice of the fact than that which may be observed by the eye. As the action of Mr. M'Ewen's safety-valve depends on a purely *physical* principle, viz.: the opposition of the elastic force of steam to the static pressure of mercury without a *mechanical* obstruction of any kind, it affords a free vent for the steam when its pressure exceeds the limit, corresponding to the length to which the tubes are adjusted, according to the strength of the boiler.

New Escapement.—At the meeting of the Royal Society on the 5th instant, a description was read of a new escapement invented by the late Captain Kater, communicated by his son Edward Kater, Esq. The great object aimed at by Captain Kater in the construction of the escapement of a chronometer is to communicate equal impulses to the pendulum through some principle perfect in itself, and not dependent for its success on superior execution. In the escapement invented by him, the pendulum merely raises a weight through an increased space in its descent. It neither unlocks a detent nor has anything to do with the train; and as the weight raised, and the spaces described, are constant quantities, this escapement is in the strict meaning of the term, one of equal impulse.

Messrs. Fourdrinier.—We are glad to observe that parliament have at length, on the recommendation of government voted the sum of 7,000*l*. to the Messrs. Fourdrinier for their important improvements in machine-paper making. Never was a national reward more justly merited.

Electro-Magnetic Nomenclature.—Much difficulty arises in naming the two poles of a battery; they are called the positive end and the negative end, the anode and the kathode, the platinode and zincode; now as each pole of a simple battery becomes reversed if the battery is doubled, Mr. Smee proposes (*Philosophical Magazine*, for May) to name the two ends from the oxygen and hydrogen, since it has been shown that the galvanic current owes its power of decomposing many substances entirely to these gases. The names which are proposed are the *oxode*, at which oxygen is evolved, and the *hydrogode*, where the hydrogen is given off.

Similar Affinities of Different Substances.—In mineral chemistry this singular observation has been made, that chlorine may be substituted for manganese in permanganic acid, without the form of the salts produced by this acid being changed. Nevertheless, it is hardly possible to find two bodies between which there exists a greater difference in chemical properties than there is between chlorine and manganese. An experiment of this kind is not to be discussed; we must leave to the fact all its value and say, chlorine and manganese may take each other's place without the nature of the combination being altered by it. From that time I do not see why this manner of acting should be considered as impossible for other bodies, such, for example, as chlorine and hydrogen. The interpretation of these phenomena, such as it has been laid down by M. Dumas, appears to me to give the key to most of the phenomena of organic chemistry. Without denying that bodies take each other's places in a great number of combinations, according to their place in the electric order, I think from the manner of acting of organic combinations, we should draw this conclusion: *that a reciprocal substitution of simple or compound bodies acting in the manner of isomorphous bodies, should be considered as a true law of nature*. This substitution may take place between bodies which neither have the same form nor are analagous in composition. It depends exclusively on the chemical force which we call affinity. —*Leibeg*.

Glass Weaving.—Few are aware that glass is now woven with silk, although its brittle nature would appear to render such a method of manufacturing it impossible. The fact, however, is indisputable, the new material being substituted for gold and silver thread, than either of which it is more durable, possessing besides the advantage of never tarnishing. What is technically called the warp, that is, the long way of any loom-manufactured article, is composed of silk, which forms the body and ground work, on which the pattern in glass appears as the weft or cross work. The requisite flexibility of glass thread for manufacturing purposes is to be ascribed to its extreme fineness, as not less than 50 or 60 of the original threads (produced by steam-engine power) are required to form one thread for the loom. The process is slow, as not more than a yard can be manufactured in 12 hours. The work, however, is extremely beautiful, and comparatively cheap, inasmuch as no similar stuff where bullion is really introduced can be purchased for anything like the price at which this is sold; added to this, it is, as far as the glass is concerned, imperishable. Some admirable specimens of the manufactured article may be seen at the Polytechnic Institution, Regent Street, especially two patterns of silver on a blue and red ground, and another of gold on crimson. The jacquard-loom by which it is woven may also be seen at the same establishment.—*Times*.

New Water Works.—The Southwark Company have purchased some land at Battersea, where it is intended to construct reservoirs for receiving the Thames water taken from that part, and allowing it to settle; and also to erect steam-engines for the supply of the district. The works have been commenced, and it is expected that they will be completed by the end of the present year, or by the spring of 1841.

Coach Wheel Retarder.—Full trial has now been made of the valuable invention of R. W. Jearrad, Jun., Esq., for retarding (not locking) the wheels of carriages when going down hill. Mr. Dangerfield, coach proprietor, having had it applied first to one of his Southampton coaches, and afterwards to the Shrewsbury coach, and in both cases with the greatest success. The principle of the invention is pressure, so applied to the nave of the wheel as to retard its motion, or at will of the coachman stop it altogether. The advantages of the invention are, that the power may be applied at the discretion of the coachman, so that he might take his coach down a steep hill without allowing his horses to be pressed upon at all. This invention reflects great credit upon Mr. Jearrad, and we hope it will be extensively applied to our four-wheeled carriages, for it will contribute greatly to the safety of the public. —*Cheltenham Journal*.

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Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 876.] SATURDAY, MAY 23, 1840. [Price 6*d*.

Printed and Published for the Proprietor, by W. A. Robertson, No. 166, Fleet-street.

SHUTTLEWORTH'S IMPROVED STEAM-ENGINE.

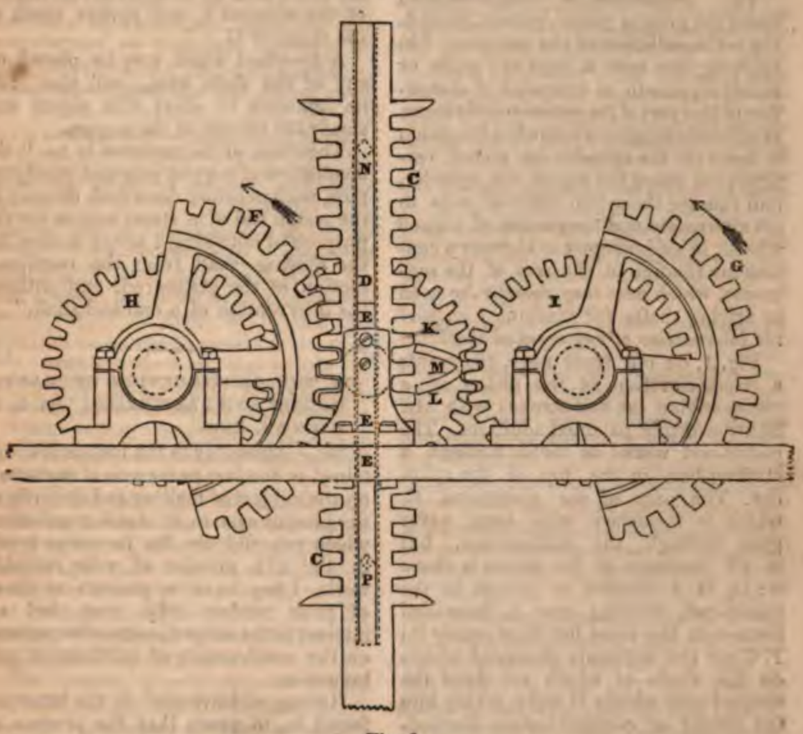

Fig. 1.

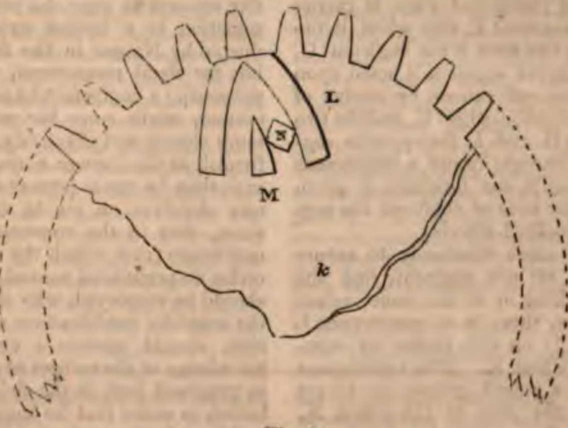

Fig. 2.

MR. J. G. SHUTTLEWORTH'S IMPROVEMENTS IN THE STEAM-ENGINE.

[Patent dated July, 1839; specification enrolled January, 1840.]

The improvements comprehended under the present patent, consist, according to the statement of the patentee, "in applying two rows of cogs and guide or steadying pins to an extension or elongation of that part of the piston-rod of a steam or other such engine which when the piston is down (if the cylinder be placed vertically) is above the top of the cylinder, and causing those two rows of cogs to act alternately upon segments of cogged wheels, in such manner as to cause a continuous rotation of the axes of the segments, which axes may thereby be used as driving shafts for machinery *without the intervention of any cranked shaft.*"

Fig. 1, on our front page, represents a front elevation of the piston of a steam-engine (at half-stroke) with Mr. Shuttleworth's patented additions. The piston-rod works as usual through a stuffing-box in the top of the cylinder. The part of the piston-rod C, which is furnished with cogs, never goes through the stuffing-box, but in all positions of the piston is above it; D, is a channel or groove in the piston-rod, working over a dovetailed feather on the cross-bar E, to steady it; F. G are two segments of cogged wheels on the shafts of which are fixed the toothed-gear wheels H and I, taking into the carrier or communication toothed-wheel, K.

When the piston-rod rises, it carries with it the segment F, and when it descends it carries with it the segment G, and as whichever segment is acted upon by the piston-rod causes, by means of the communication-wheel K, and the two gear-wheels H and I, the opposite segment to be brought round, a continuous rotary motion in one direction is given to each of the axes or shafts of the segments and toothed-wheels.

In order more effectually to secure the release of one segment, and the biting or taking in at the same instant of the other, there is a contrivance L (see figure 2) on the centre or communication wheel K. This contrivance *consists of* a raised groove or tappet *M, fixed* in the face of the wheel K, *which takes* a boss or steadying pin projecting from the piston rod at P, and thus secures the ascent of the rod sufficiently high in one case to fully release the segment F, and catch the segment G, and the descent of the rod sufficiently low in the other case to secure the full release of the segment F, and perfect catch of the segment G.

A fly-wheel which may be placed on any of the three axes, will also add its influence to effect this object and steady the motion of the engine.

The claim of the patentee is to "the application of cogged gear and steadying pins, such as before described, directly to the piston rod of a steam engine for the purpose of obtaining a rotary motion for the driving shaft from the rectilineal motion of the piston-rod, and without the intervention of a cranked shaft."

ON THE CONSTRUCTION OF MALT-HOUSES AND BREWERIES. BY G. A. WIGNEY, ESQ.

Sir,—Agreeably to the intimation contained in the last paragraph of my letter, on the subject of malting and the evils of the present system of fiscal regulation, which you did me the favour to insert in the 872 number of your valuable work, I beg leave to present to those of your readers, who may feel an interest in the subject, some observations on the construction of malthouses and breweries.

Having endeavoured in the letter referred to, to prove that the process of malting, is but a very imperfect imitative attempt to copy the process of germination to a limited extent, as conducted by Nature in the field, and that but for fiscal restrictions, the maltster possessing a competent knowledge of the system, might copy *her* method much more closely and effectively, and thereby furnish to the brewer a much superior malt than he can at present command, it now devolves on me to endeavour to show, that in the construction of the malthouse (over which the executive exercise no prejudicial control) an architect should be employed, who in addition to the requisite qualifications of his profession, should possess a comprehensive knowledge of the subject of germination, as practised both in the field and malthouse, in order that he may render the building the best adapted to enable the

maltster to assimilate his process as near to that of Nature's, as circumstances and Excise restrictions will permit.

The principal features in the arrangement of construction and fitting up of the malthouse, which require architectural and mechanical attention, are the allowance of a sufficient space for the manufacture of a definite quantity of malt under every varying circumstance—a suitable construction and fitting up of the cistern—a sufficient space for the grain in the couch—the working floors to be formed of a proper material—the kiln to be constructed on scientific principles, and to be of sufficient dimensions—provision made for the admission of atmospheric air and the emission of carbonic acid gas, without the access of light, except when indispensably needed—an ample supply of good water, and the adoption of means to render it of suitable temperature—and the supply of barley and malt stores, well situated, protected from vermin, dry and warm.

Upon each of these heads, much useful and valuable information might be furnished, but as it would occupy too much of the space of your columns, and as the impartation does not fall within the purport of this communication, I must beg leave to refer those who wish to acquire it, to my Cyclopædia for the use of Maltsters, Brewers, &c., or to my practical Treatise on Malting and Brewing for the full particulars.

The brewery may be properly termed a manufactory, in which the chemical process of manufacture of beer of various sorts, strengths, and qualities is conducted. But I am fully aware that the term chemical, is so intimately blended in the minds of many with an imaginary use of drugs, that the bare mention of it, is sufficient to awaken and alarm all their fears and prejudices, and to close at once all the avenues to their minds, if an attempt is made to introduce the subject of brewing under such an obnoxious title as *a chemical process*. But the truth must not be scared or deterred from the use of such a term, and this bugbear to many a timid and prejudicial mind, must be divested of its imaginary terrors, before the affected can ever attain to a sound and comprehensive theoretical knowledge of the subject of brewing, or a correct and advantageous practical process.

The use of the terms trituration, agitation, digestion, filtration, decoction, refrigeration, decomposition, and clarification, by the chemists, and synonymous with the terms grinding or crushing, mashing, solution, abstraction, boiling, cooling, fermentation, and fining, used by the brewer, are quite sufficient to identify the manipulations of both, as alike chemical; and hence the necessity that the brewer should so construe it, and not deem it merely mechanical,—hence the importance of his being induced to seek for a scientific knowledge of his process, and thereby learn the necessity for, and the mode of, effecting the architectural arrangements and the mechanical fittings up of his brewery, adapted and subservient to all the requisite conditions of a chemical laboratory.

The absence of this view, and requisite knowledge of the subject, in the proprietor, the architect, the builder, the engineer, and the utensil manufacturer, are strikingly indicated in the numerous heterogeneous designs for breweries, and their dissimilar erection throughout the kingdom; and much superfluous building, number and size of utensils, disorder and inconvenience of their arrangement, and a most wasteful extent of premises, are characteristic of the majority.

Conciseness and simplicity should pervade every department both of the malthouse and brewery; instead of which elaborate incongruity may be said to universally prevail, and the greatest sticklers in declaration for the former, are generally the most obstinate perpetuators of the latter; because that which they comprehend by habitual use they pronounce as simple and plain, however inconsistent, inexplicable and erroneous it may appear to others; and when any real simplification and decided improvement of their premises or system of manufacture is suggested to them, they unhesitatingly and vehemently exclaim against innovations, scheming, and complexity, and not only turn a deaf ear to every explanation, illustration, and proof, but treat the offers of improvement either with silent contempt or insulting derision.

Maltsters and brewers are not (as a rule) literary or scientific men; the greatest portion of their time is occupied in the industrious pursuit of wealth and its expenditure in pleasure when at lei-

sure. Riches have flowed in too much like a flood of abundance, to induce them to endeavour to improve their condition by the renovation of their premises and system of manufacture; and the easy and rapid acquisition has strongly tempted them to the pursuit of pleasure, and its deadening influence has closed the avenues of their minds to all the suggestions of scientific improvement; and now the day of reckoning is come to many, by a division of their once fettered and exclusive trade; the princely premises of some will echo with the term—vacuity; others will respond—diminished trade, and insufficient to cover the current expences; and foreboding ruin will resound through many an edifice, in which the din of business was once heard pre-eminent; for in proportion to the apathy of the old capitalists engaged in the trade, and the energy of the new who will be induced to embark in it, in consequence of its enlarged freedom, and the improvements which the latter will adopt and the former reject, so will be the measure of success of the letter, and the accelerated ruin of the former. The competition which naturally results from a free trade, must gradually induce those who are engaged in it, first, to seek the means to construct premises on the best adapted principle to enable them to manufacture goods of superior quality; in the next place, to construct and fit them up at the least possible cost, consistent with the accomplishment of their first object; and in the third place, to discover a system of manufacture, the best calculated to ensure the production of goods of the best quality, at the least possible cost. As an illustration of the disposition which is already faintly awakened to accomplish such a combination of purposes, and of the capability of effecting it, it may be sufficient for me to state, that the last plan which I furnished, was for a building to cover precisely the same piece of ground, on which originally stood an eight-quarter brewery, built and fitted up on much too customary a principle. The building which is now erected on the same site, comprises not only an eight-quarter brewery, but in addition to it a seventeen quarter malthouse, most convenient and advantageous in arrangement, and fitted up at so small a comparative cost to what it could have been in the customary way, that taking the cost of the building and its fittings up together, the cost of the whole but little exceeds what would have been the cost of an eight-quarter brewery alone, constructed and fitted up in the usual mode. By a new arrangement and diminution of the number of utensils, and the adoption of an improved system of brewing, the process may be effected in eight hours, from the time of turning on the first mashing liquor into the mash tun, until the whole of the worts are down into the fermenting tuns and pitched, provided there are three boiled worts; and in six hours, provided there are but two boiled and one return wort; hence it is evident, that if requisite, two brewings per day may be effected in about the same time as it is now customary to perform one in cold weather, and in much less time in hot weather than one is accomplished in such breweries as are not furnished with a refrigerator. By the adoption of this improved system not only is a brewing effected in a much less period of time, but the product also proves of much superior quality and quantity, the system comprising a superior mode of extraction in the mash tun;—an improvement in the process of boiling—a prompt cooling of the wort and transit into the fermenting tun, thereby avoiding the impartation of oxygen to the wort from the atmosphere in excess, (the frequent cause of acetification)—and the fermentation of the wort on the most correct principle. And as relates to the improved process of brewing, it is alike applicable to breweries fitted up in the customary way, by the addition of a refrigerator, as to the brewery fitted up on the new and improved system, so far as relates to the superiority of the product in quality and quantity, and the diminution of a considerable portion of the time occupied in effecting a brewing both in cold and hot weather. Nor are these the only advantages which are derived, inasmuch as a great saving of wort, fuel and labour is effected; the saving of wort by a diminution of the number and extent of surface of the utensils which it passes through, thereby causing less loss by adhesion—the saving of fuel, by the prevention of the loss of any heat (scarcely) by the wort in its transit from the mash tun to

the boiling vessel—and by the impartation of a very large amount of heat acquired by the wort in ebullition, by the conveyance of its steam into the water required to be heated for the subsequent formation of wort in the mash tun, and also by the impartation of its heat to the water used in refrigeration, in the transit of the wort from the hop-back to the fermenting tun—and the saving in labour, by diminishing the number of utensils to clean, and much of the manual and all the horse labour, by decreasing the work to perform, and the adoption of steam power.

The dimensions of the site on which this malthouse and brewery stands, are about 140 feet in length, by 18 feet in breadth.

By computing the malting season at six months, 45 steepings of barley at 17 quarters each, will enable the manufacture of 765 quarters of malt therein. In the brewery, double brewings of 8 quarters each may be daily effected, and if five brewing days per week are calculated, the quantity of malt which can be weekly brewed therein is 80 quarters, and the annual amount 4,160 quarters; and the fermenting tun and cleansing rooms are competent to enable the fermentation of the produce therefrom.

Thus, then, I flatter myself that in the construction and fitting up of these premises, I have succeeded in establishing the fact by practical proof, that in numerous cases the same space of ground that is now covered by the brewery alone is sufficient for the erection of a malthouse in conjunction—That the construction of the two manufactories under one roof, will but little exceed the cost of the brewery alone as it is usually constructed—That the diminution in the number of utensils, the substitution of less expensive for the most costly, and the diminution and simplification of the machinery, has so far reduced the usual cost of the fittings up of a brewery, as that the balance in reduction, set against the balance in excess of the building, will leave but a moderate final balance in excess of the cost of the malthouse and brewery together as fitted up, above the brewery alone and its fittings up on customary principles—That premises thus small yet of large manufacturing capabilities, requiring but a moderate outlay of capital in erection, (subject consequently to moderate rent and taxes, wear and tear) economical as to time, labour, and fuel in operation, highly advantageous in manufacturing production, and accompanied by an improved system of malting and brewing, (which, I trust, I am well enabled to furnish,) are calculated to render the old established brewer, if he avails himself of their benefits, able to stand his ground against new competitors, and to enable the latter to introduce a new era of improvement into the business, and thereby render them capable of outstripping their predecessors both in quantity and quality of product, and small cost of production.

In my next letter I propose to furnish you with a detailed exposition of the principles of refrigeration, and observations upon the several refrigerators extant.

And am, Sir,

Your obedient servant,

G. A. WIGNEY.

ton, May, 1840.

ON THE THEORY AND PRACTICE OF SOLDERING METALS. BY THOMAS SPENCER, ESQ. READ BEFORE THE LIVERPOOL POLYTECHNIC SOCIETY, 14TH MAY, 1840. COMMUNICATED BY THE AUTHOR.*

1. I am not sure that I have given this paper a proper title, and am equally uncertain as to whether the views I have to propound are absolutely the correct ones, inasmuch as there is a probability that a highly important, but subtle and active, agent may have escaped me. Of this, however I make bold to assure myself, that the ground I have taken, coupled with the practical results, are at least a

* Mr. Spencer (the same gentleman who has already so favourably distinguished himself by his discovery of the method of engraving by voltaic precipitation) in communicating this paper to us, informs us that he had given notice of his intention to read it to the Liverpool Polytechnic Society, as far back as the 18th of February last, and had previously made no secret of the process it describes; while the similar process of M. Richemont was not made public till two months later, when the first detailed account of it appeared in our pages, (see No. 872.) Mr. Spencer, however, while thus asserting his own claims to originality, very frankly and honourably adds, that he has no "doubt whatever M. Richemont made the discovery first," and that he has no wish or intention to interfere with the rights of the English patentee, Mr. Delbruck. ED. M. M.

few steps in advance, and might lead to improvements in some of our minor branches of art.

2. It was said by Sir Isaac Newton that no two particles of matter absolutely touched each other; that even the densest and apparently most compact bodies, such as the diamond, gold, &c., were in all probability highly porous. Although the microscope was not at that time in such an improved state as at present, yet subsequent observations with that most interesting instrument go very far to prove the correctness of the bold hypothesis propounded by our great philosopher. As an analogical proof of the first part of his proposition, he made the celebrated experiment with the coloured films of soap bubble, between two pieces of convex glass highly polished; when, after submitting them to as much pressure as was consistent with the safety of the material, he found it quite impossible to get any portion of the convex surfaces absolutely together, the proof being that the coloured film of soap bubble still remained apparent between the pieces of glass.

3. It was also said by this profound thinker, that if, on the separation of a material into two separate pieces, we could subsequently be enabled to bring them together as closely as they were before separation, the attraction of cohesion would necessarily take place, and the substances would again become one. I may add, merely to show the speculations of Newton on this subject, that he has said it is within the bounds of possibility, that the whole matter composing the solar system, did all the atoms absolutely touch each other, might be compressed into a space not exceeding that occupied by a cubic inch.

4. When natural philosophers speak of the *attraction of cohesion*, they are only giving a name to a certain phenomenon they observe to take place under certain circumstances; but as to the *modus operandi* by which it is governed, or what absolutely takes place, they, as yet, know nothing. By some it is termed chemical combination, or affinity, or that action which takes place on bodies at *insensible* distances, which, in other words, is that action which takes place in such a manner as to be unperceived by our *most minute* sense of observation. A *new class of* observers are beginning to ascribe this phenomenon to electrical action; but as to the method adopted by this all-pervading agent to produce its supposed effects, they are confessedly as ignorant as their predecessors.

5. I would it were this evening my humble task to throw a clear light on this most interesting, yet mysterious, problem of natural philosophy. but my object in throwing out the preceding remarks, is with the double purpose of introducing the subject I have to lay before you, as well as to draw the attention of those who may not yet have given it to this matter; and to remind them, that a vast undiscovered ocean of scientific research lies at their feet, and that much as we progressed, and are progressing, we are still wandering as it were within sight of the margin of the mighty sea on the shores of which Newton delighted to gather pebbles.

6. There are two sorts of adhesion between bodies that we can comprehend,—because we can clearly perceive their operation,—but which, after all, is not caused by the intrinsic property of the bodies employed, but by an extrinsic force acting mechanically upon them. Of such a nature is the force employed by the boy who, with a disc of leather and a cord, will draw a ponderous piece of stone; as also the force by which the hand is held to the exhausted receiver of an air pump; in either case this is due to the action of the pressure of a column of our atmosphere, and is as decidedly mechanical as if I were to fasten a ribbon to the table by merely placing a leaden weight on one of its ends.

7. The other species of mechanical combination, which is in common use, is, where we employ a viscid cement, and interpose it between the opposing superfices of any two bodies we are desirous of fastening together. Of such a nature is the operation of glueing two pieces of wood; or where we use finer and more transparent cements to join together two pieces of glass. When glue is used for wood, it is found that the softer material makes the firmest joint; for instance, two pieces of deal glued together will hold much better than two pieces of boxwood joined by similar means. On examination the reason of this difference will be sufficiently obvious. It is not because the glue has a greater affinity—to speak chemically—for the deal than for the

box; but because there is a mechanical difference in the structure of the woods —that is, the pores of the deal are large, and, of consequence, the glue is enabled to permeate its surface to a much greater depth than it could do with that of the piece of boxwood, whose pores are fine and compact, and comparatively impenetrable to the glue. In the first instance, the glue dovetails itself in the pores, and enlists the strength of the woody fibre to prevent disruption: not having equal facility of access to the harder or more closely-grained wood, less force is required to separate them. In these, and all similar instances, the adhesion is termed mechanical,—because, as we have seen, its action is perceptible, and it can be traced to the structure and strength of the materials employed.

8. We now arrive at the consideration of that force or action which we say takes place under the influence of the attraction of cohesion. We see this action manifested daily, under various guises. I may instance it in its most simple form. If we take a piece of fine pure clay, moderately wet, and cut it, or otherwise separate it, and immediately afterwards place the pieces together, it will be found they have adhered in such a manner that the joint is no longer perceptible, and it would be found impossible to separate them again at *exactly* the same place. This, then, is termed the attraction of cohesion, or that action that takes place between the molecules or particles of similarly compounded bodies. But it is worth while here to observe that, if after we have cut the clay into two portions, we then take an impalpable or fine powder,—such as calcined magnesia, fine flour, or fine whiting,—and mix them with water, and then sprinkle the parts of the clay just cut with either of the substances, on placing the pieces of clay so treated together, the cohesive attraction will not take place; or if, under any circumstances, it does so, when the clay becomes dry it will be found perfectly easy to separate the pieces at the exact place where the foreign substance has been interposed.

9. I would now draw attention to the circumstances attending the adhesion of dissimilar metals. By this I must not be understood to mean that combination that takes place when in the molten state, as when copper and zinc are fused together to form brass. Although we are in equal ignorance as to the cause in this case, as we are in all others where chemical combination takes place, yet it does not come within my present purpose to investigate this phenomenon. My object is to discover, if possible, what chemical or other action takes place during that process termed by artisans soldering.

10. My attention was directed to this subject by having seen a workman take his soldering iron (the name usually given to this implement, which is a piece of iron pointed with copper) from the fire, and having placed it on the mass of mixed metals termed solder, he was enabled to melt a portion of it by the heat imparted from the copper. Being desirous of attaching a globule of the melted metal to the instrument, he was unable to do so: on this he rubbed the point of the still hot copper on a piece of free stone—thereby brightening it—and again applying it to the solder, a globule very readily adhered, which he was enabled to transfer to the pieces he was desirous of joining together. It may be worthy of remark, that the adherence in this case was not permanent; the globule was easily detached. Of course the operation performed was a very obvious one: a film of oxide of copper had formed on the instrument by the action of heat: the stone was applied to remove it, because, so long as the film of oxide of copper interposed between the metals, they would not cohere. Philosophy has not yet shown us *why* they will not cohere under such circumstances; it has only told us that they *do* not.

11. Some months ago, in performing this operation, I had occasion to lift a globule of melted solder, when a similar obstacle interposing itself, I was led to reflect on the subject. In soldering a joint in any of the metals, let us consider what takes place. The workman, either by a file or emery paper, brightens that portion he intends to join together; or in other words, he removes the oxygen from the surface of the metal, where it is combined with it, in the form of an oxide. The next step is, to place resin on the bright portions, if for soft soldering; muriate of ammonia or muriatic acid, if for zinc or tinning; borax, if for silver or gold soldering. When

these are applied as the circumstances require, it is found the solder and the metals very easily adhere together.

12. Now, I could have very readily understood this, if any portion of the resin or borax so employed insinuated itself between the joint by way of cement, as we have seen in the case of pieces of wood when glued together; but such is not the fact. Then the question to be solved is, what part in this process does the resin, the borax, and the sal ammoniac play?

13. To solve this I proceeded as follows. I took two pieces of copper that had been brought together, by tinning in the first instance, and soldering after. By force I rent them asunder, and I observed that one of the pieces retained the whole body of the solder, while the other retained on its surface a thin coating, apparently of the tin that had been used in the first instance. The surface of the disrupted portions appearing to the eye somewhat granular, I was induced to put them under the microscope, in order that I might by this means determine, if possible, their mechanical structure, premising it as highly probable that it would be crystaline. On subjecting it to a power of the linear value of 250, I found the texture of the surface to be exceedingly irregular, and presenting *no* crystaline traces whatever, nor was there the rough splintery appearance that we occasionally meet with on the surfaces of substances recently broken; in fact, although irregular, there was still a smoothness on the surface, as if a highly elastic fluid had pressed unequally on it. On applying a still higher power, I discovered a number of semi-globules hollow, and having a bright silvery surface in the interior. These globules were about a 3000th of an inch in diameter. The deductions which I drew from these appearances I will refer to at the conclusion of the first part of this paper.

14. By this inspection, it was abundantly evident that no portion of the resin, as resin, had insinuated itself in the joint, properly so called—practically speaking, when it does, it is a bad one. But it still appeared to me as highly probable that the heat decomposed the resin into its elementary gases, and by their agency, either individually or collectively, the adhesive process was thoroughly effected. If such then were the fact, my next consideration was to determine what those gases were, and in what proportions they were combined to form resin.

15. It would appear, then, that according to the analysis made by Gay Lussac and Thenard, and one by Dr. Ure, and if we take the average of both, the results of which were nearly alike, 100 parts of resin would consist of 76 of carbon, 11 of hydrogen, and 13 of oxygen. I omit the fractious. As these analysis' were made by what may be termed destructive distillation, I was not clear as to how these gases were combined to form the resin. Of course they were combined chemically; but did the hydrogen and oxygen exist in the form of water, as was very likely to be the case?—if so, there would necessarily be an excess of about 9 of hydrogen.

16. To test this in the best manner I could, I took some powdered resin and melted it at the bottom of a very large, hard glass test tube; when cool, it was filled with mercury, and inverted over the trough. An intense heat was now applied to the end containing the resin: a white vapour was generated, which displaced the mercury, the end of the tube was now stopped and removed from the mercury and a blowpipe was applied to the end, and a very fine puncture made in it, sufficient to allow a jet of any gas generated in the tube to escape. Heat was again applied, and a stream of gas began to issue, which was set fire to. This was very evidently carburetted hydrogen, with perhaps, an excess of carbon. The heat was kept up until no more gas would issue. The puncture was now sealed up, and the tube suffered to cool, and, on examination, it contained a small portion of a brown viscid matter, which I ascertained to be napthaline, and the sides were covered with drops of water. I now inverted the tube over the mercury, and opening the end, found, as the mercury did not rise, a gas was still present. I re-opened the puncture at the uppermost end, and applied a light, when pressing the prostrate end of the tube in the mercury, a colourless jet of flame was given out, and the mercury began to ascend. This flame was hydrogen, not quite pure, as it had been accompianed with much carbon, the flame

would have had a very different colour, and if with oxygen, or atmospheric air, an explosion would have taken place; nor was the blue colour of carbonic oxide apparent.

17. My object in this experiment was, to know what takes place during the application of *as much heat* to the resin as is applied in the operation of soldering; and by it I was led to infer, that any oxygen that does exist in the resin exists in the form of water.

18. Had I applied the heat of the furnace, and put the resin in a porcelain tube, it is clear I should have had oxygen in the state of gas; but a heat equal to this is not required in the operation, and, in practice, if the iron is too hot it does not succeed. As it appeared from this experiment that hydrogen was present,—and that, too, in a state of comparative freedom, and supposing that this gas was the predisposing cause of the adhesion which we observe to take place in the process of soldering, it appeared highly probable, then, that any substance that would admit of a still greater portion of hydrogen to be set free by the soldering iron would, in a practical sense, answer the purpose still better than resin.

19. In reasoning thus, I may observe I have long had a predisposing bias,—if I may so term it,—in favour of the opinion, that hydrogen plays a far more important part in the metallising process of nature than is generally imagined. There are a few chemical facts, it is true, that afford *prima facie* evidence in favour of this hypothesis; but they are not yet sufficiently numerous or conclusive to warrant the super-position of a theory on so narrow a foundation.

20. My next procedure was, to ascertain the substances having a chemical composition analogous to resin. These I found to be the following:—First, naptha—it being composed of 6 equivalents of carbon and 6 ditto of hydrogen; second, bees' wax—it containing 13 of carbon, 1 of oxygen, and 11 of hydrogen; camphor—its chemical composition being 10 of carbon, 8 of hydrogen, and 1 of oxygen. Common oil of turpentine I also thought of—it being composed of 13 of carbon, 10 of hydrogen and 1 of oxygen.

21. Suppose, then, we place these substances in a tabular form, with a reference to their relative value in hydrogen —oxygen being combined in these substances in the form of water.

	Carbon.	Hydrogen.	Oxygen.	Hydrogen unconnected with Oxyg.
Pure naptha....	6	6	0	6
Bees' wax......	13	11	1	10
Oil turpentine..	13	10	1	9
Resin	13	11	2	9
Camphor	10	8	1	7

To form water, if we combine an equal numerical amount of oxygen with a corresponding amount of hydrogen, we then get the fourth column of the table, which will be the amount of hydrogen unconnected with oxygen.

22. From this I felt assured that, if my *a priori* reasoning were correct respecting hydrogen, all the substances named in the table, and many others, might be employed for the purposes of soft soldering, and that bees' wax would have a superiority over the others, seeing that a greater portion of this gas would be liberated. I accordingly submitted each of them to the test of experiment; that is, in forming a series of joints with soft solder I substituted each separately for the resin commonly used, and found I was able to accomplish the object with the utmost facility; but I gave the preference to *bees' wax*.

23. As these experiments seemed to favour, in a degree, the opinions I had previously entertained respecting the agency of hydrogen gas in the operation, I now became desirous of testing them further, by projecting a stream of hydrogen on a joint, to be soldered by means of the water blow-pipe. The evening I formed this intention I had not the pneumatic apparatus to generate and collect hydrogen in order; but having made the previous experiments by the light of carburetted hydrogen, and knowing, as before stated, this gas was eliminated during the soldering process, I fastened a condensing syringe to the burner and pumped a portion into a gas holder, with the intention of ascertaining how far it might answer the purpose. I succeeded in obtaining a few pints of this gas, and subjected it to the pressure of a column of water. I then attached

an elastic tube to the gas holder, having a safety blow-pipe jet at its opposite end. I now applied the heated soldering iron to a portion of solder I was desirous of attaching to a piece of lead, and then directed the point of the blow-pipe to the spot. My object in this was, that the cohesive operation should take place in an atmosphere of the gas. This operation succeeded, the metals cohered, but I thought not so speedily as they had done with the bees' wax; however, I imagined this might be from an excess of free carbon.

24. Next day I generated some hydrogen by the action of dilute sulphuric acid, on granulated zinc. I threw a jet of the gas so obtained on a portion of tin I was desirous of fastening to a piece of copper, at the same time using the hot iron as before. This last experiment I found succeeded worse than any of the others, the tin having only partially adhered to the copper; but being somewhat unwilling to abandon the idea that had been so successful hitherto, I thought it extremely probable the gas might have brought over a portion of water from the trough in which it had been collected.

25. In order to obviate this, I passed a second portion of hydrogen through a tube containing chloride of calcium, with a view to its desiccation, and collected the gas in a bladder, that it might not in any way come in contact with water. I applied the portion of gas thus heated in the same manner I did in the preceding experiment, and had the satisfaction of finding that *complete adherence* instantly took place between the two metals.

26. As far as theory went, I had been enabled to verify my predicaments by experiment, but, as yet, had shown nothing that could warrant me in the opinion, that they would lead to any immediate practical results, it being clear, that first to generate hydrogen, by whatever means, *coupled* with the use of the soldering iron, would, at best, be a roundabout method of performing the operation.

27. To get rid of the hot iron altogether became my next object of pursuit. To effect this, I directed a stream of hydrogen on two pieces of lead I was desirous of fusing together, in the manner termed by plumbers *burning* a joint, *while, with* the mouth of a blow-pipe I *directed a* stream of ignited carburetted hydrogen on the same portion of the metals. As might have been anticipated, the flame invariably ignited the hydrogen gas, but I partially succeeded in fusing the pieces of lead together. From this I was induced to hope that, by some modification of the apparatus, I might ultimately succeed in this desired object.

28. I had been long familiar with the use of the oxy-hydrogen blow pipe, and its action on the reduction of metallic ores and oxides, but this experience convinced me that its action would be far too potent, for the object I have in view, that is, supposing the gases were combined in the proportions usual in the application of this instrument; but the experiment I have just narrated led me to believe it was more than probable, that were the gases combined in different proportions, my inquiry might be attended with successful results.

29. My object now became to discover a method of decreasing the intensity of the oxy-hydrogen flame. One of your members, whom I have frequently observed use the oxy-hydrogen blow-pipe to illuminate the magic lantern, led me to the adoption of the most simple method. It would sometimes occur that the mixed gases would not hold out the required time; on such occasions, it was his practice to pump a quantity of atmospheric air into the vessel containing the diminished portion of the mixed gases. This seemed to answer, to a certain extent, pretty well, the intensity of the flame being, however, somewhat diminished. In these cases there were no definite proportions used; at all events, it was very clear the more atmospheric air, the less intense became the flame.

30. Bearing this in view, I now decomposed water by the aid of the galvanic battery, and collected the mixed gases in due proportions. To the quantity thus obtained I superadded an equal portion of atmospheric air, and applying to the gas holder, the safety blow-pipe (Hemming's jet) in the manner already described, I ignited a stream of the gases, and directed the flame thus obtained on a piece of tin I was desirous of attaching to a piece of sheet copper,—adherence at once took place. I next directed the flame on two pieces of lead, the edges being brought together; but

found that the flame was far too intense, a hole being fused wherever the flame was directed, and apparent oxidation took place on the surface. To get rid of the intensity of the flame I added a greater portion of atmospheric air, and, on doing so, found it very much less intense; but, at the same time, it rapidly oxidised the surface of the lead, and adhesion between the two pieces took place very partially. It appeared now abundantly evident, that there was an absence of hydrogen, and to supply the apparent deficiency I generated some in the usual manner, and added a portion of it to the gas holder containing the mixed gases and the air. I now directed an ignited stream of this mixture on the edges of two pieces of lead brought together, and found they were very neatly and expeditiously *fused into one.* I tried the same mixture on two pieces of copper, without the intervention of solder or tin, but found this combination of the gases not intense enough to fuse the edges together; but at the same time, had no doubt but a well regulated mixture would answer the desired object.

31. In these experiments, I wish it to be borne in mind, that the orifice of my blow pipe was necessarily small, and from the construction of my gas holder he water pressure was very slight, otherwise I might have attained the object with less difficulty—my purpose being merely to point out the principle to the public, and to let those branches of business where it might prove useful carry it out.

32. I had proceeded thus far with this branch of the subject, when I gave our secretary notice of this paper: this is now three months ago. Previous to this period I detailed the principles of process to a number of individuals, many of whom are members of this society. I also detailed it to persons practically engaged in business requiring the process, and requesting them to give it a trial. I mention this because the same principle has, within the last three weeks been patented by a French gentleman, who has received, in consequence, some very high honours in his own country, and taken out a patent in this. I very much regret the latter, as my own intention was to publish it at once; and as it is, I *am not sure that* it can be sustained, I having detailed my process to so many before his specification was made public. I shall, however, take no steps in it myself, as I never meant to profit by it in a pecuniary sense; my present object being to redeem the pledge I gave the society to read the paper. I shall, however, be most willing to give the required information, as to the amount of publicity I gave it, to any who may be desirous of using the process free of the patent restriction. There is, also, a slight difference in the method employed by M. Reichemont—it being, as far I have seen, only applicable to fuse together the edges of lead—it being a mixture of hydrogen and atmospheric air only. To fuse together the harder metals will, I apprehend, require the adoption of my method of applying the greater amount of artificially acquired oxygen.

Reasoning from the facts already laid down, our next inquiry will be, what part in the preceding processes does the hydrogen really perform? Is the action that takes place, apparently under its influence, chemical or mechanical? For the word chemical I might have more properly substituted the word electrical, as we now resolve all, hitherto termed chemical, changes into electrical action.

I shall now adduce some of the reasons that may be brought forward in favour of either method of explanation, premising it as highly probable it may be due to a combination of both, which still further research may resolve into one.

In support of the mechanical action of the gas, it must be borne in mind, that whenever an attempt is made to make a junction by soldering, it is necessarily performed in an atmosphere containing 21 per cent. of oxygen, this latter gas having a decided tendency to combine, in a greater or less degree, with nearly all known metals, and the product of such combinations being the metallic oxides, which in themselves exert an opposing influence on the combination of metallic bodies. The oxidisement of the metals is also rapidly increased by the degree of heat they are necessarily subjected to under the process. On the other hand, we are aware that hydrogen has a tendency of a very opposite nature. Metals may be preserved in brilliancy by placing them in pure atmosphere of this gas. The most ox-

idisable metals known, potassium and sodium, are only to be preserved by placing them in a fluid containing an immense proportion of this gas, having an entire absence of oxygen. Admitting the preservative tendency of hydrogen—whether passive or active, I shall not stop to inquire—if the soldering process is performed in an atmosphere of it, unaccompanied by oxygen, the surfaces of the heated metals would remain pure, and allow combination the more readily to take place. It is true, if hydrogen exert an *active* chemical action on the metals *per se*, it would materially alter this part of the position.

In favour of mechanical action there is another point as yet untouched. Hydrogen is the lightest of known bodies; by some it is said that its utmost molecules are also the smallest. One proof in support of this I may adduce. If a bell glass receiver is used to collect oxygen gas, having a slight crack in any portion of it, still the gas may be collected with impunity, as no leakage will take place; but if, on the other hand, we attempt to collect hydrogen with the same receiver, an escape of gas will at once take place. Should this view be the correct one, the inference would be, that the normal particles of this gas being smaller, a thinner stratum is interposed between the metals than when any other gas is present, and, consequently, allowing them to approach so closely, that a moderate degree of heat is sufficient to allow the attraction of cohesion to take place. This is somewhat in accordance with the opinion held by Newton, already mentioned. I am also informed that attractions of this description take place between pieces of plate glass, when laid on each other, and that it is found impossible to separate them. This latter phenomenon respecting the escape of hydrogen has been recently explained by referring it to a principle possessed by the gases of displacing each other in the ratio of their density. If so, it would tend to invalidate any inference of an opposite kind drawn from the fact.

Passing from this head, which has perhaps detained us too long, I shall now very briefly advert to a few other topics, which, even in a general sketch like this, it would be unpardonable to leave unnoticed.

It was a favourite opinion of many of the older chemists, that hydrogen was the basis, or substratum, of all metallic bodies. I, of course, lay no particular stress on this, further than saying it is highly probable that the metals *are compounds*. Wherever we look on nature, we find all perfect, harmonious simplicity, and the greater is the amount of grandeur displayed by the very small number of agents employed; but when nature is viewed through the medium of chemistry we have a multiplicity of agencies, all having apparently different properties. Now, had I no other proofs than those analogies afforded me by the contemplation of the other kingdoms of nature, I should at once doubt that she was less simple in this portion of her empire than we can demonstrate her to be in all the others.

Supposing this opinion respecting hydrogen were true, it would at once solve the difficulty. The hydrogen might be supposed to act as other fluids do upon the substances into whose composition they enter, just as oil is the best thing to soften oil paint, or turpentine or spirits of wine their respective varnishes. But this is little better than mere opinion. Certainly it was said (I think by Berzelius) at one period, that the metals potassium and sodium were compounds of hydrogen, inasmuch as the portion of this gas contained in the hydrate of potassia, from which it is usually made, was never satisfactorily accounted for. This is yet an unsolved problem. Again, we have the very curious metallic mixture of mercury and ammonia—ammonia, it will be recollected, being a compound of hydrogen and nitrogen.

I shall terminate this paper with a word on the chemical or electrical theory. It is laid down as an axiom that bodies similarly electrified repel each other, and dissimilar states of electricity attract each other. Hydrogen then is an electro-positive body, and so are the metals. According to this, this gas, instead of being attracted by the metals, would, in point of fact, be repelled. To further ascertain the action of electricity on this process, I brightened two slips of copper and attached them as poles to a galvanic battery. They were dipped simultaneously into a crucible containing melted tin. In a few seconds they were removed. On examination

the tin had but partially adhered to each pole alike. I then dipped similar pieces of copper into the crucible, but not attached to the galvanic battery; on examination they were *completely tinned.* I draw no inference at present from this, but state the fact.

I have made many other experiments on the junction of the harder metals, with curious results, but think them as yet not conclusive enough to lay before the public.

In the theoretical portion of this paper, I wish it to be borne in mind, that I lay no particular stress on any one method of explanation more than another. They are only adduced in a brief way, to show what might be said in support of either. The carbon liberated in the case of the resins may perform its part in the deoxidising process as well as the hydrogen. Also, the nitrogen contained in the atmospheric air pumped into the receiver, containing hydrogen, when again projected in the mixed state on the heated metal, may act as a metalising agent, as we know *it does* when thrown on mercury. But, after all, if we could readily perform these processes *in vacuo,* it is probable the agency of any of the gases would be rendered quite unnecessary. In conclusion, it is quite clear that, whatever may be the agent, the hydro-oxygen blow-pipe, and a modification of the proportionals of the gases, may now be applied economically for practical purposes.

DEFECTS OF MACHINE-MADE PAPERS —MR. E. SMITH IN REPLY TO MR. BADDELEY.

Ill health has prevented my taking notice of Mr. Wm. Baddeley's elucidatory remarks on my hastily-written strictures on the defects of machine-made paper, which appeared in your Magazine. I certainly must take blame upon myself for commiting so egregious an error as I did in the passage which that gentleman has so properly reprehended. The fact is, I committed a grave fault, in forwarding my letter to the press without a previous careful perusal, and thereby have justly exposed myself to the comments of a correspondent who ranges with such ability and zeal,

"From theme to theme, from theory to facts."

and who throws a mental light, (this is no flattery I assure you Mr. Editor, but honestly deserved praise) upon every subject which his discriminating pen handles.

I have not at this moment the Magazine by me which contains Mr. Baddeley's letter, and therefore cannot reply to it as I could wish. Neither have I health or leisure to place into argumentative array many of those sundry points which I pledge myself to do upon some forthcoming occasion; I shall, for the present, merely observe, what I think Mr. Baddeley will admit, that for fineness of texture, evenness of surface, and firmness of body, no machine papers can equal the best writing imperials, demys, mediums, posts, foolscaps and pott papers which are made by hand. Let Mr. B. make enquiries of any account book maker as to the truth of my assertion, and I am certain he will find it amply confirmed.

I beg respectfully to contradict what Mr. B. says on the head of the Royal Cartridge Paper I spoke of. Had the lot been sorted in the way he speaks, the varying proportions would have proved too heavy or too light for the market.

Admitting that there is a proportion of machine-made paper of good quality at the present time, I fearlessly assert that there never was so much trash of many kinds deluging the market as there is now. Examine those books on the shelves of a circulating library, which have been printed within the last few years, and which have gone through a course of general reading, and you will find, owing to the spongyness and soft defective quality of the paper they are composed of, that the leaves will, but in few instances, adhere after a little time to the binder's thread. The different volumes become from this cause loose and disjointed, and consequently soon fall to pieces and become valueless. This is the case even with many of our works of first-rate merit in ornamental literature. But if you happen to look over a volume of Harrison's or Cooke's novels (the former printed as far back as 1784), before machine papers were known, you will find the different sections of the book holding together firm and whole, and as well fitted fo reading as on the day it was put int

form by the binder. Or, take Bell's common edition of the British Theatre, published before the aforesaid introduction of "Fourdrinier's post and other yellow wove varieties"; and compare it with Longman and Co.'s edition of plays published at double the price on machine-made and superior *looking* paper, and you will find that Bell's edition, like a hale veteran, is still whole and firm, while Messrs. L. and Co.'s can scarcely bear handling.

As for any agreeable sensations arising from superior cheapness in publications of the present day over those of old, I deny the fact to be so, except in a very few instances. Forty years ago, those respectable periodicals, the *Gentleman's*, the *Monthly*, the *Universal*, the *European*, the *Monthly Mirror*, &c. were published for the price of one shilling, with as much literary matter as the same class of publications contain now for half-a-crown.*

Another prevailing evil in paper making at the present period, is the stinting of the different sizes, which is done on purpose to give them a recommendatory substance; this is a species of fraud loudly and justly complained of.

ENORT SMITH.

THE PENNY POSTAGE.

Sir,—To find fault even with the details of so excellent a measure as the Penny Postage seems an ungracious task; but we have the authority of no less a personage than Lord Brougham for the assertion that a new and untried system is most quickly and most firmly established by being "well picked to pieces" at first starting. Fortified by this opinion, I shall proceed at once with a clear conscience, to animadvert on several points in the *execution* of the scheme, in which there appears a superabundance of room for improvement.

The great objection to allowing the public to stamp their letters for themselves arises from the fear of forgery; and, during the progress of the preparations, we were repeatedly assured that such precautions would be taken, as to render forgery impossible. But what is the fact now the covers and stamps are issued? It turns out that there is nothing about them which might not be successfully imitated by the most ordinary engraver, or copied in lithography, with the utmost ease. It must be recollected that the postage stamps can only be subjected to a very cursory examination, as it would never pay to keep a body of officers to examine minutely *every penny stamp*, even if there were time for the operation. Under these circumstances, any tolerable resemblance may be expected to pass muster without much chance of detection, as it will have but to bear the scrutiny of the fraction of a moment. Even if the design had been extremely complicated, and aided by all the resources of modern art, such as it was expected would have been called into action, forgeries might still have been got up with some chance of escaping in the necessary hurry of Post Office business; but what will be the case now, when *fac similia* may be produced without any difficulty, undistinguishable, even at leisure, from the originals? A penny seems but a small sum for the forger to realize, but when it is recollected that a single sheet of stamps will produce One Pound, it will be perceived that the temptation is by no means small.

In the printed covers there is indeed a peculiarity. Some months ago we were told that they would have the benefit of a process patented by Mr. Dickinson, the paper manufacturer, by which elaborate figures were worked into the paper in various-coloured silks, in such a way as not to be imitable except by the use of his patent, and then only by very expensive machinery, quite out of the reach of the common forger. Now, that we have the covers before us, how does the matter turn out? Why, each cover when folded, shows a few inches in length of two or three *straight lines*, so exactly in the fashion of the ruled faint lines in account books, that it requires close and diligent examination to discover any difference! A ruler, with a very small quantity of red and blue ink, is, therefore, all that is required to stand in the place of the "patent machinery" that

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* "*As much* literary matter" there may have been—though of that we are not sure—but that it was *as good* cannot with truth be said. In nothing has the march of improvement been more decidedly manifest, than in the character of our periodical literature. *More* talent is shown now-a-days in an ordinary *Magazine* contribution than would have sufficed some forty or fifty years ago to build up a most respectable literary reputation. ED. M. M.

was to have had such potent effect; for "elaborate figures" we have straight lines, and for a "very peculiar appearance" we are put off with the one most familiar to the eyes of the stationer. There is plainly no security here.

But there is yet another stumbling-block: both covers and stamps are either lettered or numbered, a precaution the intent of which it is difficult to fathom. Each cover must per force be used separately, so that if a whole sheet (a dozen) be originally printed all with the same number, the Post-office authorities will have no means of discovering the fact from the isolated covers; but there is no reason why the forger should not print twelve different numbers, like the Post-office itself; one way is just as easy as the other. As two or more of the *stamps* may be used together, more circumspection would be called for in their case; but as soon as the 240 heads (all exactly alike and consequently easily multiplied) are engraved, all difficulty is over. Even one head would suffice for single letters: a thousand forged stamps all marked "B. L." for instance, might be put in the post on the same day, and what assistance would the lettering give in their detection? Obviously none whatever; unless some great mathematical genius should be employed to calculate how many of the millions upon millions of stamps issued, ought, by the laws of probability, to bear a particular pair of letters on a particular day. It is impossible indeed to imagine the utility of the numbering system, except it should be intended to change the numbers suddenly at times, and declare the stamps issued with the old numbers of no avail; a measure which would cause inextricable confusion, create an unheard-of mass of trouble and vexation, and after all stand in the way of the forger but for a short period;—until he had time to imitate the new issues. Stamps for other purposes, it may be observed, are exposed to more minute examination than those for postage. Private parties have a stake, sometimes a very heavy one, and in its nature of long duration, in the genuineness of the stamps and generally speaking they are preserved for a time; not so with postage stamps; none but the Post-office authorities have any stake in the matter, and that only, in each individual case, a very small one—the mere value of the stamp; and besides all this, the purpose of the forger is effected in a moment—once past the sorter or stamper at the Post-office, all is over; the forgery has effected all that was intended, the letter is delivered, and all evidence of fraud destroyed, or at least gone entirely from the hands of the defrauded. Above all things, therefore, it was requisite that the means of detection should be exceedingly great, and, if possible, of instantaneous application. Those now adopted are not worthy of the name, and indeed the only obstacle to forgery worth mentioning, consists in the difficulty of vending the spurious stamps. The loose manner in which the business of distribution is *at present* conducted, however, is such as to remove much of this obstacle, and the very extensive nature of the trade, when the system is in full operation, will always unavoidably afford but too great facilities for the dishonest vendor.

It is, perhaps, hardly worth while to remark on the very inferior character of the covers as works of art, as the laugh is so strong and so general against them, and their substantial demerits at the same time are so great, that they will most probably be soon withdrawn. After the many puffs preliminary which heralded their appearance, the unanimity of their condemnation is indeed wonderful. The friends of Mr. Mulready must themselves admit that he has produced a drawing singularly deficient in "significance." What peculiar bearing a negro heading up a cask has upon the subject, to entitle his effigies to a place on every Post-office letter-cover, it would puzzle "the Wizard of the North" himself to divine,—nor are the naked Australian in the background, or the groups of camels and elephants on the other side, much more in place. Surely an elaborate border worked in colours, would have had a much better effect in point both of beauty and utility, while it would have had a recommendation which the present design greatly lacks. It would have taken up little room, and therefore left sufficient space for writing the address, the want of which is one of the many real faults of this ungainly and inconvenient cover.

Why should the Post-office trouble itself to provide covers at all, or, as it is intended shortly to do, take in paper to be stamped? If adhesive stamps only

had been issued, according to Mr. Rowland Hill's original plan, the simplicity of his scheme (so much insisted on) would have been preserved, an infinity of complexity and consequent trouble saved, and at the same time the public would probably have been quite as well accommodated, the stationers being left, as they might safely have been, to prepare covers and envelopes, *with the adhesive stamp attached;* which would have answered every purpose, without interfering with the unity of the plan. In its progress to maturity the scheme has strangely enough lost every feature of that simplicity which was originally held forth as its greatest recommendation. The idea of rating according to distance was scouted simply on the ground that, unless the payment for each letter was the same, the old complicated and expensive method of "charging," which we were assured cost more than the carriage of the letter to its destination, could not be done away with. This reasoning had its force, and contributed greatly to the success of the measure. But what is the result? By the extension of weight allowed for a letter to sixteen ounces, each ounce with a separate charge, (the first with two) the old necessity for expensive machinery remains the same as ever, with the addition that each letter now requires weighing into the bargain. Why the Post-office should extend its business to "small parcels" at all, no one seems able to tell, unless it were thought desirable to give the *coup de grace* to the stage coach proprietors, already run half off their legs by the railways. The effect has been ridiculous enough; all sorts of commodities now find their way through the post, including gooseberry bushes, extraordinary cucumbers, *steam-engines*, (small models) and *live stock* (leeches). Considering that the Post-office was established for the conveyance of *letters* only, would it not have been as well to continue the old restriction as to weight (one ounce) and with it the peculiar beauty (that was to be) of the new system—uniformity of charge? This would at any rate have precluded the necessity of publishing an advertisement cautioning the public to be careful in enclosing their *glass bottles* (!) as well as the prosecution of a postman for the novel crime of *purloining* a *watch* from the inside of a letter. There need be no fear but that such ware as watches and glass bottles would reach their destination without the assistance of Government, by more legitimate channels than the letter-bags of Her Majesty's mails.

I remain, Sir,

Very respectfully, yours,

H.

London, May 14, 1840.

MATHEMATICAL DEMONSTRATIONS.

Sir,—I think it would preserve a good deal of your valuable space to better purposes, if such of your correspondents as think it necessary to give demonstrations of well known trigonometrical formula, would copy them at once from some known author, and cite the authority: it would guarantee conciseness at least, and freedom from repetitions.

Of Mr. Scott's oft-amended solution at page 454, the ownership of which (by his proposing its demonstration as a sort of prize question) one would really think he meant to claim, many demonstrations, ready cut and dry, might be found: there is one, for instance, in Maddy's Plane Astronomy, deduced from Napier's circular parts, and occupying altogether not more than five short lines: with a little amplification and alteration, it might be made to look as good as new, and quite original.

As for the method of computation at page 410, which Mr. Scott treats with so much severity, it was the favorite one of Andrew Mackay, LL.D. F.R.S., author of the well known treatise on the longitude; in which work it is frequently given by him as a familiar practical rule for the use of seamen: of course, no one would think of citing *him* as an authority against Mr. George Scott.

NAUTILUS.

May 14, 1840.

USE OF THE WORD "PATENT."

Sir,—In the letter of Mr. Baddeley contained in your Magazine of May 16, he asserts that the custom of applying the word patent to *unpatented* articles was prohibited under penalties, and in a note in your editorial capacity you confirm Mr. B.'s impression. In the original bill of Lord Brougham such a clause was

inserted, but there is no such clause in the Act itself. All that the Act imposes is "*a penalty of 50l. for using unauthorised the name of a Patentee.*" Certainly there is no penalty for applying the word patent to an unpatented article. Why it was struck out of the original bill I am not prepared to say. The *custom of trade* is to be deprecated, which in *Birmingham* calls an article *patented* when it is not, and in *London* a thing *town made* when the fact is otherwise. It would best serve the interest of morality and of sound commercial dealing too, if in Birmingham and London, the *custom of trade* were always to tell the truth, come what may.

I am, Sir,
Yours respectfully,
R. PROSSER.

2, Cherry-street, Birmingham,
May 18, 1840.

[Our friend Mr. Prosser is right. In penning the note alluded to, it had escaped our recollection that the clause in Lord Brougham's bill, as it originally stood, imposing a penalty for the application of the word "Patent" to articles not patented, was dropped in the progress of the bill through the House. The reason we are equally at a loss with Mr. Prosser to divine. It was a very proper clause, and would have put an end to much gross imposture. ED. M. M.]

PATENT LAW—WOOD PAVEMENTS.

Sir,—In looking over the patent case in your No. 852, it struck me that his Honour the Vice-Chancellor had very cleverly upset two opposing patents by an adjudication on only one of them. The dispute is as to the use in paving of blocks of wood whose grain, or rather perhaps faces, are inclined. Parkins claims the inclination of "from about 45 to 70 degrees." Hodgson (or the Count de Lisle) prescribes and claims a certain angle produced by cutting a cube in a particular way. The former, the judge says, is not sufficiently definite, and that patent he would thus *legally* upset. The latter, he says, is definite and good as a patent; but then, if good because so definite as to the angles it follows that it is open to all the world to use other angles as near to the patent one as they please, and thus as to all *practical* effect, is this patent upset too; for angles of five degrees on either side of the patented one, will make pavements just as good as it will.

For all this, however, it is clear the law and not the judge is to blame. The case is another, and somewhat singular illustration of the still wretched state of the patent law.

The effect of the decision on the adoption of wood paving, or even on the interests of the immediate parties, when all comes to all, will probably be very small; for the question of paving is not *mainly* a question of blocks, wood, or stone, upright or inclined, square or hexagonal, but of foundation.

I am, sir,
Yours respectfully,
LECTOR.

May 14, 1840.

"ARCHITECTURAL PRECEDENTS.*"

That a very useful work of the description indicated by the above title, might have been produced, and that the editor of the one before us commenced with a very correct notion of what was wanted, are two facts which we are well prepared to admit; but there needs only the briefest possible contrast in this case between design and execution, promise and performance, to show that the editor has missed his way most deplorably.

The Preface states that for the sake of systematic arrangement, the illustrations of each number will be *preceded* by practical observations on the arrangements and requisites suitable for buildings of various kinds." No. I., however, contains no such "practical directions," but the following vapid apology for their *absence*: "This *we hope* to offer when referring to our detailed illustrations of working drawings, in a *subsequent* part of this work."

"The young man was *absent*—because he was not *there*."

The Preface states, moreover—for the sake also, we presume, of "systematic arrangement,"(1)—that each part or *number will be complete in itself*. Now, in Part I., we have an essay begun on "Architectural Practice," but *not finished*,

* Architectural Precedents, with notes and observations, illustrated with working drawings. Edited by An Architect. Parts I and II.—Williams.

and the same essay resumed in Part II., and left *still unfinished*—if essay, indeed, that can be called which consists almost entirely of a copy, *literatim et verbatim*, of the well known Metropolitan Building Act.

No. "1" means usually something which is not only numerically, but substantially, the first order, or as they say at Lloyd's, A 1; but No. I of these "Architectural Precedents" bears this most incongruous title: "No. I. Plans, Elevations, Sections, Specification, and Bill of Quantities of *Second Rate Buildings*."

The truth is, that "systematic arrangement" there is none, and of original practical observation nearly as little, except in promise. Such specifications as the editor could most readily obtain access to, have been published as they came to hand, without any reference whatever to their absolute or relative merits.

The engravings are better than the letter-press accompaniments; on a small scale certainly, but nevertheless, sufficiently clear and intelligible.

IMPROVED METHOD OF PREPARING GELATINE OR GLUE, INVENTED AND PATENTED BY MR. GEORGE NELSON, OF MILVERTON, CHEMIST.

Mr. Nelson describes his invention as consisting—1, in applying a caustic alkaline solution, either with or without acids to all such cuttings of hides and skins as glue pieces are commonly made of (taking care, however, to reject such as are in a putrescent state,) and—2, of employing acids alone (sulphurous acid in a liquid state excepted) for that purpose uncombined with any alkaline solution. By these means he obtains gelatine of two qualities, which he calls *first* and *second*.

In manufacturing his first quality of gelatine, Mr. Nelson employs a caustic alkaline solution with sulphurous acid gas in manner following:—

"When the cuttings have been freed from hair, flesh, and fat, and washed clean in cold water, I score the grain side of them to the depth of about an eighth part of an inch, in lines about an inch apart, in order to facilitate the action of the alkali which I use, and to render such action more uniform. I then macerate them in a caustic solution of alkali at a temperature of about 60 degrees Fahrenheit, using for this purpose brick vats, or vessels lined with cement in the ordinary manner, and these vats or vessels, which I call the macerating vessels, must be covered with lids excluding the general atmosphere; any vessels which are not acted upon by the alkali, may be used. I thus macerate the cuttings until I can pass a fork or any other similar instrument through them with little resistance, and I generally find that they are sufficiently macerated in about ten days. The alkali which I prefer for my solution is soda, and I prefer my solution in the ordinary method, using three parts of the common soda of commerce, with two parts of fresh-burnt lime to sixteen parts water; or any quantity of fresh-burnt lime sufficient to render the solution caustic may be used. When the process of maceration is sufficiently complete, as already pointed out, I remove the cuttings from the solution, put them into vessels similar to the macerating vessels, and which must also be covered with lias, excluding the general atmosphere, and I leave them in such vessels thus covered until they have become sufficiently soft. It will be ascertained whether they have become sufficiently soft by passing a fork or other similar instrument through them, and when they have become sufficiently soft, the fork or other instrument will pass easily through them. Whilst the cuttings are thus left to become soft, they must be kept at a temperature between 60 and 70 degrees of Fahrenheit, and as they become sufficiently soft as above pointed out, I remove them, and I slice or split such of the cuttings as are materially thicker than the others, in order to bring them to the same, or nearly the same thickness. I then put the cuttings into wooden cylinders, placed in water vessels filled with clean cold water, but care must be taken not to put into any cylinder more than half the quantity which it is capable of containing. These cylinders, which I call washing cylinders, must be constructed in such manner as to allow water to pass freely through them, and they may be fitted in the water vessels in any convenient manner to allow of their revolving within such vessels, I secure the cuttings within these cylinders, and then I cause the cylinders to revolve slowly in the water. I have found cylinders of three feet in diameter a convenient size, and I cause these to revolve at a speed of about one revolution in a minute. Whilst the washing cylinders are thus revolving, I cause a current of water to be kept up through each of the water vessels by means of an aperture at the bottom of the vessel at one end, and a pipe at the top of the opposite end, through which pipe clean cold

water is continually supplied. I continue the cylinders revolving in a current of water, as I have described, until the alkali is sufficiently washed out of the cuttings, and I generally find six or seven days sufficient for this washing, when I use cuttings of ordinary thickness; but when I use cuttings which are thicker than these I continue the washing in proportion to the thickness of such cuttings. When the cuttings have been thus washed I remove them from the washing cylinders and place them in a wooden closet, constructed in the ordinary method to prevent the escape of gas, and there expose them to the direct action of sulphurous acid gas, produced by the combustion of sulphur within the closet. I continue the cuttings thus exposed to the direct action of this gas, until they have a slight excess of acid, and I ascertain whether they have an excess of acid by testing them with litmus paper in the ordinary manner. I then remove them from the closet and press them by any ordinary means to separate as much water as possible; and after they have been thus pressed, I put them into glazed earthenware vessels, or any other vessels which are not acted upon by acid. I call these vessels steam-baths, and I apply steam to them in the manner usually employed for heating steam-baths, but any other convenient means of heating them may be used; I thus bring the cuttings to a temperature of about 150° Fahrenheit, and I keep them at this temperature and by means of a suitable wooden instrument I stir or agitate them until they are almost entirely dissolved. The liquid thus formed is gelatine, and I separate it from the residuum which remains undissolved by straining, and put it into vessels which I call settling vessels, and which are constructed in the same manner as the steam-baths. I heat these settling vessels in the manner which I have already pointed out for heating the steam-baths. Whilst this liquid gelatine is in these settling vessels it should be kept at a temperature between 100° and 120° of Fahrenheit, and I allow it to remain undisturbed in the settling vessels, for the purpose of clearing it, until I consider the impurities which it contains have sufficiently settled or subsided. I generally find nine hours sufficient for this purpose, but if the impurities have not sufficiently settled or subsided in that time, I prefer to clear it by straining it through a woollen cloth. I remove the liquid gelatine from the settling vessels by means of a syphon, but any other suitable means may be used for this purpose, and after it has been sufficiently cleared I pour it upon slabs which I call cooling-slabs to the depth of about half an inch. These slabs may be of stone or marble, but they must have frames of some convenient material, at least half an inch in depth fitted to their edges, and care should be taken to place the slabs in cool situations. I allow this gelatine to remain upon the slabs until it becomes cold and sets into a firm substance, and I then cut it into pieces, and wash these in the washing cylinders and water vessels which I have already described, in the same manner as I have already mentioned for that purpose in respect to the cutting, as I take them from the macerating vessels. This washing must be continued until the excess of acid is entirely or nearly altogether removed from the gelatine, and I generally find that 3 days are sufficient for this purpose; but I ascertain whether the excess of acid has been removed by testing the gelatine with litmus paper in the ordinary manner. After the excess of acid has been thus removed, I take the gelatine from the cylinders and put it into the steam-baths, and then dissolv it by applying heat to the baths in the manner which I have already pointed out for that purpose; but it will be desirable to avoid raising the temperature of the gelatine above 85° of Farenheit. When the gelatine has been thus completely dissolved, I pour it again upon the cooling slabs, as before, and I allow it to remain until it becomes again cold, and sets into a firm substance. I then cut it into pieces of any convenient size, and dry it upon nets by exposure to a current of cool dry air, and when it has been thus completely dried, it is fit for use."

The gelatine of the second quality is prepared, without the aid of any alkaline solution, by merely steeping cuttings in a weak solution of sulphuric acid, or subjecting them to the direct action of sulphurous acid gas, until in either case they have imbibed "an excess of acid." After this they are kept in wooden barrels for three weeks, at a temperature of about 70°, and then put into a steam-bath and entirely dissolved. A liquid gelatine is then obtained, which is treated in the same manner as the liquid gelatine mentioned in the process before described, until it is completely dried and fit for use.

ON THE EXISTING FORMULÆ FOR THE CALCULATION OF STEAM POWER — FALLACY OF TREDGOLD'S CALCULATIONS.

Sir,—The complaint I believe is not uncommon among practical men of the insufficiency of all the theories on the steam engine which have been hitherto promulgated, and the inadequacy of any

rules based on these for deducing anything like a correct estimate of its power under general circumstances; and nothing, I imagine, can be more obvious to those seeking to be enlightened upon the subject, by a reference to the professed expounders of its principles, than the great want of agreement among them, ranging, as it does, from one quarter to three quarters of the pressure in the boiler. The evil of this may perhaps, with some truth, be attributed to the thoroughly practical character of our engineers, who, satisfied with the working results, have neither the leisure nor inclination to seek beyond. The English are *practitioners* more than *theorists*, and are necessarily deficient in that patient and tedious classifying of facts so essential to the evolution of general principles; and in this, as in most of the physical sciences, it will probably remain for our neighbours to deduce from our complicated data some fixed and acknowledged laws available for all times and for every purpose. I must confess that I, in common no doubt with many others, have experienced some disappointment, that the late expensive edition of Tredgold, which certainly for its typographical and graphical excellence does infinite credit both to the taste and spirit of its publisher, should yet, with all its elaborate and rather ostentatious display of learning, have done little to remedy the defect so generally complained of. From the great reputation of Tredgold, and the known talent of his editor, we were naturally led to anticipate something like an exposition of the *true principles* of the steam engine, and a rectification of many obsolete errors. But I will appeal to any one, more particularly to practical men who have ever attempted to derive from it information upon any dubious points connected with the subject, whether they have not been more embarrassed and confused than anything else, by the apparently additional complexity in which it has involved it, and preferred on the whole putting up with the doubt to having their faith shaken in what they already knew. The fact is, Tredgold's Treatise is far from being free of the besetting sin of most modern elementary works — of overlaying both the sense and beauty of the text with numerous complicated analytical formulæ, and the absurdly bad taste of resorting upon every trifling occasion to the assistance of the *higher calculi*, which, to say the least of it, appears not only to be a piece of unnecessary pedantry, but has often the positive ill effect of obscuring and investing with an air of mystery even the most simple propositions. Now an expertness in the intricacies of a transcendental analysis, does not exactly comprise every requisite for a work of this kind, for however desirable a certain degree of speculative or technical learning, may be as elucidative of the principles upon which practice is based, it should be remembered that it is the intimate combination of the two which alone constitutes sound and useful knowledge.

With reference to Nautilus's letter, p. 723, I beg to remark, that the difference in the coefficients 536 and 6, as affecting the values of the pressures on the piston, is not so slight as he seems to imagine, being nothing less than the point at issue between our two calculations. In other respects they are precisely the same, which Nautilus will readily discover by the least consideration. I have not an opportunity of immediately referring to Mr. Galloway's History of the Steam-engine, but presume that the mistake has arisen from Nautilus taking the rule for an engine working *expansively*, instead of for one at *full pressure*. Otherwise I cannot account for the already high estimate of friction being increased nearly $\frac{2}{7}$. But the mistake may in some measure have originated from supposing that Tredgold had given four-tenths of the *total* pressure in the boiler, instead of that which is exclusive of the atmosphere as the quantity to be deducted to get the effective pressure on the piston—the contrary of which, however, mght have been inferred from the example subsequently given—and this appears to be a general misapprehension, and one that, strangely enough, the Chevalier de Pambour, in his rather severe strictures upon Tredgold, has not only fallen into, but taken the pains to set right by a correction.

It will be seen from the following extract how Tredgold has formed his estimate for the amount of deduction for loss, &c. He says, (art. 367, edition, 1827), for non-condensing engines, acting at full pressure:—"The effective pressure on the piston is less than the

excess (above atmospheric pressure) of the force of steam in the boiler, when that force is represented by unity, by

1st. The force producing motion of the steam into the cylinder	.0069
2nd. The cooling in the cylinder and pipes....................	.0160
3rd. The friction of the piston and waste	.2000
4th. The force required to expel the steam into the atmosphere......	.0069
5th. The force expended in opening valves, and friction of the parts of the engine	.0622
6th. The steam being cut off before the termination of the stroke....	.1000
Total	.3920

"which" he adds, "we may consider 0.4, and then the effective pressure is 0.6 of the force of the steam in the boiler, *diminished by the pressure of the atmosphere.* Whence we have the following rule for an engine of this sort, $[\phi\times.6-(11.5\times.4)]\times a^2\times v=$ power of engine in lbs. raised one foot high per minute. Where $\phi=$ excess in boiler per circular inch above atmosphere, $a=$ diameter of piston, and v velocity in feet per minute.

Thus it will be seen that the co-efficient .6 according to Tredgold is not to be applied to the *total* pressure in the boiler, but only to its excess above the atmosphere, and as for the co-efficient .4 of this latter quantity in the formula—both the last edition and that of 1827, most unaccountably neglect to explain its purport. But the omission I trust I may here venture to supply. The atmospheric pressure since it acts upon the opposite side of the piston, where alone it is effective, should properly only at that point be accounted for, but in consequence of this deduction being made from the force of the steam in the boiler, it is necessary that there should be some farther reduction equivalent to what the same amount would have undergone ere reaching the piston. Hence its fraction $\frac{4}{10}$ for the absorbed power as given above is to be substracted.

This process which it will be observed is precisely the same as $(\phi\times11.5)\times.6-11.5,)$ becomes necessary since the negative amount for loss, &c., is taken in terms of the pressure above the atmosphere. Had it been in terms of the total pressure the co-efficient used by Nautilus would have been very nearly *the true one, not materially differing from that given by Pambour.*

In offering this explanation it must not be imagined that I by any means subscribe to the correctness of the data upon which this rule of Tredgold's is founded. The third element alone in the above estimate of lost power, is in itself preposterous, and although somewhat exaggerated from the misconception before alluded to, it is shown by de Pambour (Theory of the Steam Engine, p. 12) that in the case of an engine having a working power of 100 horses—40 would be necessary to draw its piston alone.

But the main defect of this method of calculation (and I scarcely know how it is to be obviated,) is that the above resistances being all in terms of the original pressure, it follows, that an engine of half the size working with double the pressure, or two small engines each of half the size, with the same pressure, would all be subject to the same loss, and consequently the same loss in economy of working. I need not observe how totally irreconcilable this is with experience.

I should regret if it were thought I had spoken with disrespect or undue severity of a work, which certainly, if it were only for the untiring and laborious researches it displays in clearing away the obscurity and confusion which hung around the earlier history of the steam-engine—independent of the information to be derived from it, even as regards minor details, is entitled to our deepest gratitude. There is a degree of veneration attached to Tredgold, from his having been the first to attempt anything like a definite theory of its action, and also from his being regarded so long in the light of a supreme court and authority in practical science, beyond which there was no appeal, that to disturb him "*in his pride of place*" or call in question his decision—savours somewhat of temerity. Nevertheless, in the present state of our knowledge, a theory based upon the results of experience alone, available for practical purposes and by practical men, is certainly a desideratum, and it cannot, I think, be said that Tredgold entirely fulfils either of these conditions. However, in support of what no doubt will yet be considered by many, a bold heresy upon my part, I cannot, in concluding, do better than quote the opinion of Professor Moseley, whose scientific knowledge and general attainments, will assuredly entitle him to a

judgment on the subject. He says, "It is due to the interest of science to state, that these calculations (Tredgold's) appear to be grounded in no sound or recognized principles: they are deduced from formulæ, which are to be considered as scarcely more than empirical, and which do not appear to be borne out by the practice of the steam-engine." (Illustrations of Mechanics, p. 387.)

INDICUS.

May 19, 1840.

SAVAGE'S DICTIONARY OF THE ART OF PRINTING.*

Of the numerous Dictionaries published, or in course of publication, by Messrs. Longman and Co.—all of which do great credit to the judgment and enterprise of that distinguished house—this Dictionary of THE ART, without which there might never have been either Dictionaries or Publishers, and but a very small modicum of either Literature or Civilization—(Mechanic Arts doubtless, but no *Mechanics' Magazine*)—promises to be one of the most correct, curious and useful. The author, Mr. Savage, is well known for his passionate devotion to the Art which he has undertaken to explain and illustrate, and to more experienced or abler hands the task could hardly have been confided. We have now but No. I. of the work before us, but the following specimens will suffice to *justify* the favourable anticipations we have formed of it.

"*Alphabet.*—Tacquet, an able mathematician, in his Arithmeticiæ Theor., *Amst.* 1704, states, that the various combinations of the twenty-four letters (without any repetition) will amount to

620,448,401,733,239,439,360,000.

Thus it is evident, that twenty-four letters will admit of an infinity of combinations and arrangements, sufficient to represent not only all the conceptions of the mind, but all words in all languages whatever.

Clavius the Jesuit, who also computes these combinations, makes them to be only 5,852,616,738,497,664,000."

Ancient Customs.—The following customs used in printing offices in former times are extracted from Moxon's Mechanick Exercises, published in 1683, the first practical work that appeared on the Art of Printing. I insert them because I think it interesting to trace the old customs, that were established by printers to preserve order among themselves; and to show the changes that have taken place since that period. The insertion of them in this place will also tend to preserve them, as the original work is now very scarce, and this department of it has been superseded by subsequent publications, which, however, with the exception of Mr. Hansard's work, have not copied these customs.

"*Ancient Customs used in a Printing-house.*

"Every printing-house is by the custom of time out of mind, called a *chappel;* and all the workmen that belong to it are *members of the chappel;* and the oldest freeman is *father of the chappel.* I suppose the stile was originally conferred upon it by the courtesie of some great churchman, or men, (doubtless when chappels were in more veneration than of late years they have been here in *England*) who for the books of divinity that proceeded from a *printing-house*, gave it the reverend title of *chappel*.

"There have been formerly customs and by-laws made and intended for the well and good government of the *chappel*, and for the more civil and orderly deportment of all its members while in the *chappel;* and the penalty for the breach of any of these laws and customs is in printers' language called a *solace*.

"And the judges of these *solaces*, and other controversies relating to the *chappel*, or any of its members, was plurality of votes in the *chappel*. It being asserted as a maxim, *that the chappel cannot err*. But when any controversie is thus decided, it always ends in the good of the *chappel*.

1. Swearing in the *chappel*, a *solace*.*
2. Fighting in the *chappel*, a *solace*.
3. Abusive language, or giving the ly in the chapel, a *solace*.
4. To be drunk in the *chappel*, a *solace*.
5. For any of the workmen to leave his candle burning at night, a *solace*.
6. If the *compositer* let fall his *composing-stick*, and another take it up, a *solace*.
7. Three *letters* and a *space* to lye under the *compositers case*, a *solace*.
8. If a *press-man* let fall his *ball* or *balls*, and another take it up, a *solace*.
9. If a *press-man* leave his *blankets* in the *tympan* at noon or night, a *solace*.

"These *solaces* were to be bought off, for the good of the *chappel*. Nor were the price of these *solaces* alike; for some were 12*d*. 6*d*. 4*d*. 2*d*. 1*d*. *ob*. according to the nature and quality of the *solace*.

"But if the delinquent prov'd obstinate or refractory, and would not pay his *solace*

* "Dictionary of the Art of Printing," by William Savage, author of Practical Hints on Decorative Printing, and a Treatise on the Preparation of Printing Ink. No. I. 48 pp. 8vo. Longman & Co.

* Fine, from the Latin Solatium.

at the price of the *chappel*, they *solac'd* him. * * *

"Any of the workmen may purchase a solace for any trivial matter, if the rest of the *chappel* consent to it. As if any of the workmen sing in the *chappel*, he that is offended at it may, with the *chappels* consent purchase a penny or two penny *solace* for any workmans singing after the *solace* is made; or if a workman or a stranger salute a woman in the *chappel*, after the making of the *solace*, it is a *solace* of such a value as is agreed on.

"The price of all *solaces* to be purchased is wholly arbitrary in the *chappel*. And a penny *solace* may perhaps cost the purchaser six pence, twelve pence, or more for the *good of the chappel*.

"Yet sometimes *solaces* may cost double the purchase or more. As if some *compositer* have (to affront a *press-man*) put a wisp of hay in the *press-man's ball racks*; if the *press-man* cannot well brook this affront, he will lay six pence down on the *correcting stone* to purchase a *solace* of twelve pence upon him that did it; and the *chappel* cannot in justice refuse to grant it; because it tends to the *good of the chappel*; and being granted, it becomes every members duty to make what discovery he can; because it tends to the further *good of the chappel*; and by this means it seldom happens but the aggressor is found out.

"Nor did *solaces* reach only the *members of the chappel*, but also strangers that came into the *chappel*, and offered affronts or indignities to the *chappel*, or any of its members; the *chappel* would determine it a *solace*. Example,

"It was a *solace* for any to come to the *King's printing-house* and ask for a ballad.

"For any one to come and enquire of a *compositer*, whether he had news of such a galley at sea.

"For any to bring a wisp of hay, directed to any of the *press-men*.

"And such strangers were commonly sent by some who knew the *customs of the chappel*, and had a mind to put a trick upon the stranger.

"Other customs were used in the *chappel* which were not *solaces*, viz., every new workman to pay half a crown, which is called his *benvenue*. This *benvenue* being so constant a custome is still lookt upon by all workmen as the undoubted right of the *chappel*, and therefore never disputed; yet he who has not paid his *benvenue* is no member of the *chappel* nor enjoys any benefit of *chappel-money*.

"If a journey-man wrought formerly upon the same printing house, and comes again to work on it, pays but half a *benvenue*.

"If a journey-man *smout* more or less on another printing house, and any of the *chappel* can prove it, he pays half a *benvenue*.

"I told you before that abusive language or giving the lye was a *solace*: but if in discourse, when any of the workmen affirm any thing that is not believed, the *compositer* knocks with the back corner of his *composing-stick* against the lower ledge of his *lower case*, and the *press-man* knocks the handles of his *ball stocks* together: thereby signifying the discredit they give to his story.

"It is now customary that journeymen are paid for all Church holy days that fall not on a *Sunday*, whether they work or no, and they are by contract with the master printer paid proportionably for what they undertake to earn every working day, be it half a crown, two shillings, three shillings, four shillings, &c.

"It is also customary for all the journeymen to make every year new paper windows, whether the old will serve again or no; because that day they make them, the master printer gives them a *way-goose*; that is, he makes them a good feast, and not only entertains them at his own house,* but besides, gives them money to spend at the ale-house or tavern at night; and to this feast they invite the *correcter*, *founder*, *smith*, *joyner*, and *inck-maker*, who all of them severally (except the *correcter* in his own civility) open their purse-strings and add their benevolence (which workmen account their duty, because they generally chuse these workmen) to the master printers: but from the *correcter* they expect nothing, because the master printer chusing him, the workmen can do him no kindness.

"These way-gooses are always kept about Bartholomew-tide. And till the master printer have given this *way-goose*, the journey-men do not use to work by candle light.

"If a journey-man marry, he pays half a crown to the *chappel*.

"When his wife comes to the *chappel*, she pays six pence; and then all the journey-men joyn their two pence apiece to welcome her.

"If a journeyman have a son born, he pays one shilling.

"If a daughter born, six pence.

"The *father* of the *chappel* drinks first of *chappel drink*, except some other journeyman have a *token*; viz. some agreed piece of coin or mettle markt by consent of the

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* *Tempora mutantur! Eheu!* For "own house," read *White Conduit House*, or any other public house of entertainment.—Ed. M. M.

chappel: for then producing that *token*, he drinks first. This *token* is always given to him who in the round should have drank, had the last *chappel drink* held out. Therefore when *chapel-drink comes in*, they generally say, *Who has the token?*

"Though these customs are no *solaces;* yet the *chappel* excommunicates the delinquent; and he shall have no benefit of *chappel-money* till he have paid.

"It is also customary in some printing houses that if the *compositer* or *press-man* make either the other stand still through the neglect of their contracted task, that then he who neglected, shall pay him that stands still as much as if he had wrought.

"The compositers are jocosely called *galley slaves:* because allusively they are as it were bound to their *gallies*.

"And the *press-men* are jocosely called *horses:* because of the hard labour they go through all day long."

"*Apostrophe.*—Authors frequently, in the hurry of writing, abbreviate their words and use the apostrophe; but a compositor, however his copy may be written, should never abbreviate any word in prose works, except he be particularly ordered so to do.

"The apostrophe is also used in printing to close an extract, or to show where it finishes; and in dialogues, frequently, to close each person's speech; in both cases it is usually put close to the end of the word, without any space before it, except where the word finishes with a kerned letter, and then a hair space, or one just sufficient for their preservation is used; when it comes after an ascending letter, a hair space should also be put between them."

The author should have noted here that when the apostrophe is used "to close an extract" it is always (or should be) doubled, thus ('); but that when employed as in dialogues, "to close each person's speech," it is (or should be) single only, as (').

"*Bad work.*—Any fault at the case or press, is in workmen's language called *bad work.—M.* We now call it *bad workmanship;* and by the term *bad work* is understood solid matter; that is, not leaded, with long paragraphs; no white lines nor branching out; no short pages; nor any white pages; such work is also called *a solid dig:* any other work is also called *bad work*, that is tedious in the execution, or difficult to perform, and does not fetch the workman a remunerating price.'

"*Balls.*—Two circular pieces of pelt, leather, or canvass covered with composition, stuffed with wool and nailed to the ball stocks, used to cover the surface of the article to be printed with ink, in order to obtain an impression from it. Moxon says they were occasionally stuffed with hair; and that if the ball stocks were six inches in diameter the ball leathers were cut about nine inches and a half diameter. They are made larger, according to the work they are required for; those used for newspapers were the largest.

"Pelt balls are superseded in London by composition balls and composition rollers, and nearly so in the country; but when I recollect that the most splendidly printed English books were executed with pelt balls, and that a printer may be so situated in the country, or in some foreign place, as not to be able to procure composition balls or rollers, I think it useful to give directions how to make and manage balls of pelts, so that wherever a printer may be situated, he may sustain no great inconvenience, provided he has a skin at his command: and I shall in the first place give an old pressman's directions for this purpose, who was well and practically experienced in every variety of presswork, and who wrote them expressly for this work.

"'The pelt being well soaked, the pressman scrapes with the ball knife a little of the wet and filth off—twists it—puts it on the currying-iron, holding an end in each hand, and curries it, by pulling it strongly backwards and forwards, till it becomes warm and pliable, and the grease adheres to his hands, so that the pelt is in danger of slipping out of them while currying: without treading he cuts the pelt into two equal parts, across, and scrapes both sides of them; he then lays one of them on a press stone, or on any other stone that is large enough, and stretches it and spreads it well with the grain side downwards: the pelt of an old ball being well soaked, he cleans it, scraping it partially, so that some of the moisture may remain in it, and spreads it on the new pelt, as a lining, but does not stretch it nearly so much as the new one, and then nails an edge of them to the ball stock: the wool, being previously carded or combed, he lays in single locks one upon another, crossways, till he has enough for the size of the ball which he is making. If it be for a newspaper it must be very large; if for bookwork, to be used with common ink, it must be smaller in proportion; but in both cases he brings the ends of the locks of wool into one hand, forming it into the shape of a ball very slightly, and puts these ends into the bowl of the stock; then bringing the opposite edge of the pelt to that already nailed, he also nails that to the ball stock; then he nails two other parts of the pelt op-

posite to each other, between those parts before nailed; then he plaits the pelt, nailing it regularly on the ball stocks; and cuts off the superfluous edges of the skin. The linings ought to be large enough to be nailed to the ball stock equal with the skin. Then he makes another ball, exactly the same as the first; and if both have a full even face, with no hillocks or dales, he has got a pair of good balls.

"'After having knocked up his balls, he washes both them and the stocks well, and lets them lie out of the water a quarter of an hour; then placing one edge of the face upon the edge of the bank, the coffin of the press, or upon any other convenient place, and the end of the ball stock against his breast, he takes the handle of a sharp table knife in one hand and the end of the blade in the other, and scrapes it regularly and rather strongly from the plaits to the face of the ball, at every scrape turning round the ball, which brings out such a quantity of grease and moisture, as obliges him at the first to wipe his knife at every scrape; he thus proceeds, till he can scarcely bring any more out of the skin. He then places a sheet or sheets of paper on the face of the ball, and rubs it well with his hands, till the ball is thoroughly dry, his companion doing the same to the other ball: they then begin to work the form.

"'If a pressman has to execute fine work with strong ink, he stuffs the balls harder with wool than he does for weak ink; because strong ink lugs or stretches the skin very fast, and soon slackens the balls, if not hard stuffed.'

"I was several years employed on fine work and strong ink, in an office where it was not allowed to tread a skin; this circumstance caused me to try the above-mentioned plan, and experience has taught me that it is by far the most preferable method.

"'I also know by experience that a greasy skin is the best for strong ink, if treated in this manner, because it always keeps mellow until the balls are worn out, and there is less trouble in capping them.

"'Making balls is a nasty job: there is an old proverb in the trade, that '*The devil would have been a pressman, if there were no balls to make;*' that is, the printer's devil.'

"Tanned sheep's skins, dressed with oil, have been used, to avoid smell, and for durability; they were more durable than pelts, but they were not calculated for producing fine impressions, not being soft; and, in consequence, not retaining dirt or other extraneous matter on their surface; this occasioned picks, and rendered them unsuitable for printing small letter or fine engravings with neatness.

"When the pressmen leave work at night the pelt balls are capped; that is, they are wrapped up, each in a blanket steeped in urine; and this is always done when they are not in use; it keeps them soft, and in working condition; but they are to be scraped, and dried with paper, to get rid of the moisture, each time they are wanted. There have been many attempts to supersede the use of urine, on account of its disagreeableness and smell; but no substitute, to my knowledge, has answered the purpose so well with pelts.

"Composition balls and composition rollers have, as I previously observed, superseded the use of pelt balls in the metropolis, and nearly so in the country. This has arisen from their superior cleanliness and sweetness, and being equal to pelts in producing good work. They can also be procured, generally, at the moment they are wanted, in the best working state; since their introduction the manufacture of them has become a new business, and they are supplied at so moderate a rate, (either per week or quarter), and may be renewed as often as required, that scarcely a printing office in London, at the present day troubles itself to make balls; and hence no pressman need ever complain of having bad balls as an excuse for bad workmanship.

"These balls will be found peculiarly convenient in small offices, where even one press is not in constant employment; for they may be kept for any length of time without injury to them; and if they be preserved in a proper temperament, will be always ready for use at the moment required. If they should become a little too dry, they may be restored to a proper state for working in a very short time by sponging them over with water, and distributing them; or, if there be time, by placing them in a damp situation, in order that they may imbibe moisture.

"They may be easily made in an office at a distance from town, where it may be both inconvenient and expensive to have them removed backwards and forwards, by having a shallow dish formed of tin, &c. pouring the melted composition in it, and before it is cold attaching a piece of canvass to it sufficiently large to form a ball of the size wanted. The facing will be thus thicker in the middle and taper off to the edge, which will be quite thin; and the edge of the composition should be continued well over the rounding of the ball, to prevent it ever touching the form in beating, and thus avoiding any ill effects from portions of ink or dirt that would lodge at the extremity of

the composition, and come in contact with the types or engraving."

"*Batter.*—When the face of any letters gets injured in a form, it is termed a batter.

"This accident frequently occurs:—in the course of working at press a letter or letters will draw out in beating, and occasionally be left on the form without being perceived; this, when the next impression is pulled, injures the page on which it was left,—a pin, needle, or bodkin, used as pickers, will sometimes be laid on a page and forgot—and other small articles, which produce the same injury. It also happens with forms reared up at the ends of frames, where the faces of the letter in the forms are put to each other, with a quoin, or a piece of furniture, to prevent them touchiug, which being accidentally displaced, the letter gets injured. The only thing to be done when these accidents occur, is to replace the letters; this, however, is too frequently done without showing a revise to the reader or overseer; and thus errors creep into a work which no care on the part of a reader can prevent. To steady careful men these accidents seldom happen, and they ought to be guarded against, in as much as they cause loss of time to the workmen, and expense of materials to the master printer; and when letters or words must be replaced, the work should never be proceeded with at press, previously to its being examined.

"When a fine engraving on wood is at press, the workmen should be most particularly careful, as an accident might thus spoil an expensive work of art, which it might be impossible to replace.

"When a batter unfortunately happens at press in working stereotype plates, it is too frequently overlooked by the pressmen, and the work proceeds in a deteriorated state; while, generally speaking, if the same accident had happened to a form of moveable types' it would have been set right. The reason is, that while in the latter case the accident could be remedied in a few minutes, the stereotype plate on the other hand would have to be taken out of the form and sent to the founders, and would not be repaired in less than five or six hours, during which time the pressmen would be unemployed, to their loss. This is one cause that operates against the more general use of stereotype plates."

FLOATING BRICKS.

The ancients were in possession of a method of making bricks which, though they had very considerable strength and remarkable power of resisting heat, were yet of such small specific gravity that they floated on the surface of water. Pliny says expressly that they were made at Pitane, in Asia, at Marseilles, and at Colento, in Spain; and used for various purposes, especially in the construction of buildings on the decks of large galleys. Like many of the more splendid arts of the ancients, the material of those bricks was unknown, and the method of making them lost, for a number of years. About the year 1790, or perhaps a little earlier, Fabbroni, an Italian, turned his attention to the subject, and, after various experiments upon different minerals of small specific gravity, he at last discovered that these bricks must have been composed of the substance called "mountain meal;" or, at all events, he found that he could make of this substance bricks which, in as far as the details are handed down to us, agreed in every repect with those described by the ancients. This mountain meal is an earth which, upon analysis, M. Fabbroni found to contain 55 parts of flint earth or silica, 15 of magnesia, 12 of clay, 3 of lime, 1 of iron, and 14 of water. The bricks which he formed of this material had the property of floating in water, and many other valuable properties besides. They could not be fused by any ordinary degree of heat and so low was their conductive power, that while one end of the brick was red hot, the other could be held in the hand without the smallest inonvenience to the person holding it. There is no reason whatever to doubt the truth of Fabbroni's statement, or the fact that he found this mountain meal in great abundance near Casteldelprano, in Sicily. Now, what I wish to know is, whether this mountain meal is chemically the same as the substance under that name which is so plentiful in Cornwall, and which is not unfrequently used in adulterating the flour of wheat. In this adulteration, though a fraudulent, it is by no means a deleterious substance; but if it is identical in its chemical composition with the mountain meal, upon which M. Fabbroni made his experiments, it could be turned to many very useful purposes, without any fraud whatsoever. It possesses three very valuable qualities.—First, its small specific gravity; secondly, its infusibility by fire; and, thirdly, its very low conducting power. All these render it a most eligible material for every erection on shipboard, in which fire is to be in any way employed,—as, for instance, in the cooking apparatus of all descriptions of craft, and in the furnaces of steam vessels. For such it is better suited than any of the descriptions of brick now in use, not only because it is fully one-half lighter in an equal bulk, but also because it is less destructible by fire, and a better guard against

the fire's destroying anything around it; because, though building with this material is only the length of a single brick in thickness, it can bear to be kept red hot on the inside, while the outside, instead of charring, would not greatly heat timber, though in immediate contact with it. It might also be found a very valuable material for packing, between the cylinders of steam-engines and their external cases. In short, the three properties which I have named, and of which the experiments of Fabbroni have shown it to be possessed, will point out to such as are conversant with the engineering arts very many useful purposes to which this description of brick, or of brick earth, might be applied; and, besides those actually useful ones, it might also be made to answer many purposes of pleasure. I shall mention only one, and that is, the construction of floating houses upon ornamental waters. At present, such structures can be made only of timber; and, paint them up as the owner may, there is always a flimsy and unsubstantial air about them, and the weather has a powerful effect upon them. If, however, a wooden platform were employed as the base of the whole, and the weight so contrived as to keep this platform constantly under water, it would, if made of proper timber, last a very long time. Then the upper part of the structure, formed of these floating bricks, might have all the appearance, and, indeed, almost all the real stability of a brick house upon land; for this description of brick is as durable against the influence of the atmosphere as it is against fire; and, although it is not absolutely so strong as the heavy brick in common use, it is far more so in proportion to its specific gravity. M. Fabbroni, in his very small work upon the subject, published at Florence in 1791, states that these bricks are very little inferior in strength to common bricks. If they are desired to be stronger, one-twentieth part of allumina or pure alloy may be added to their composition, without lessening their buoyancy in any material degree. The proportion of their weight in bricks 7 inches long, 4½ broad, and 1 inch and ¾ in thickness, was found to be 5 pounds 6¾ ounces, in compact common brick, and only 14½ ounces in the floating brick. Notwithstanding this, these bricks unite with lime and resist water as well as the common bricks do, and they may be used either unburned or burned. In burning they shrink very little, far less indeed than common bricks, though they lose ⅛ of their weight, and acquire a sonorous or ringing quality. Altogether this combination of earths is a very curious and interesting subject; and not the least advantage which it possesses over timber, is its perfect indestructibility by fire. These are the reasons why I am so anxious to ascertain whether the mountain meal of Cornwall is an analogous substance, or whether it could be rendered so by any admixture.—*Correspondent of the Surveyor, Engineer, and Architect.*

MAGNETIZING POWER OF THE MORE REFRANGIBLE SOLAR RAYS.

Professor Morichini, of Rome, was the first to observe that steel, when exposed to the violet rays of the solar spectrum, becomes magnetic. Similar experiments were tried by Mr. Christie in 1824; but the most accurate experiments upon this subject were performed by Mrs. Somerville, in 1825, who determined that not only violet, but indigo, blue and green, develope magnetism in the exposed end of a needle, while yellow, orange, and red, produce no sensible effect. As many philosophers have failed in repeating these experiments, Mr. G. J. Knox, and the Rev. T. Knox, were induced to undertake the investigation of a subject, "which has so often disturbed science," and the following is the result of their labours as laid before the Royal Irish Academy on the 24th February last:—"Having procured several hundred needles, of different lengths and thicknesses, and having ascertained that they were perfectly free from magnetism, we enveloped them in white paper, leaving one of their extreme ends uncovered. Taking advantage of a favourable day for trying experiments upon the chemical ray, (known by the few seconds required to blacken chloride of silver,) we placed the needles at right angles to the magnetic meridian, and exposed them for two hours, from eleven to one, to the differently refrangible rays of the sun, under coloured glasses. Those beneath the red, orange, and yellow, showed no trace of magnetism, while those beneath the blue, green, and violet, exhibited, the two first feeble, but the last strong traces of magnetism. To determine how far the oxidating power of the violet ray is concerned in the phenomena, we exposed to the different coloured lights needles whose extremities had been previously dipped in nitric acid, and found that they became magnetic (the exposed end having been made a north pole) in a much shorter time than the others, and that this effect was produced in a slight degree, under the red (when exposed a sufficient length of time), strongly under white glass, and so strong under violet glass, that the effect took place even when the needles were placed in such a position along the magnetic meridian, as

would tend to produce, by the earth's influence, a south pole in the exposed extremity. Conceiving that the inactive state produced in iron (as observed by Schœnbein) when plunged into nitric acid, *s. g.* 1.36, or by being made the positive pole of a battery, or by any other means, might throw some light upon the nature of the electrical change produced, experiments were instituted to this effect, which showed that no trace of magnetism could be thereby produced."

SULPHUR MINES OF IRELAND.

Those manufacturers of sulphuric acid, who now use pyrites, and have made trial of Irish sulphur ores, find that by care they can obtain more than 33 per cent. of sulphur from the county of Wicklow sulphur ore, which is quite different in its qualities from iron pyrites or mundic. The mode of extracting the sulphur used to be as follows:—Kilns being built with rough stone and clay mortar, in shape either cylindrical or circular, with the bottoms level. Flues, made with bricks (a little asunder), were laid across the bottoms, so as to communicate with apertures left near the ground at opposite sides of the kilns. Over these flues, pieces of wood, chips, furze, &c., were placed, and the kiln was then filled with ore, broken into small pieces, but not so small as to run any danger of their choking the draught, or preventing a free circulation. A connecting flue was next built over the ore, to convey the sulphur into an arched receiver—the outside of the whole being coated over with clay mortar, to prevent escape of the sulphur, or admission of rain. The kiln was thus prepared for "lighting," which operation was effected by keeping fuel burning at the apertures described as connected with the bottom flues, until a sufficient degree of heat was given to the ore within reach of the fire, to insure its communication with a further quantity, so that, on removing the fire, and closing up the apertures to a certain degree, sublimation of the ore would be effected by spontaneous combustion; when the whole process was properly managed, a kiln, containing seventy to eighty tons, was commonly "burnt out" in about two months time. The quantity of sulphur collected in the receiver depended in so great a measure on the proper care and attention of the persons employed to repair the constant cracks and openings made in the walls, and covering of the kilns, by the burning mass they confined, and the process being carried on in the open air at all seasons, it was to be expected that considerable "escape," or loss of sulphur, would take place—nevertheless, a vast quantity of ore was burnt in this manner, and the sulphur either refined, and made into "cane brimstone," or disposed of as collected; and prior to the reduction of import duty during the war, so high as 30*l.* per ton has been obtained for county Wicklow sulphur. It would occupy too much space were I to go on at present to describe the methods used for separating and obtaining the copper remaining in the ore of this calcination.—*Correspondent of the Mining Journal.*

THE ALKALI MANUFACTURE.

During the time of Scotch corruption, and Scotch influence in high quarters, an exorbitant duty was laid upon all foreign kelps and barillas, aimed, in a great measure, at the prohibition of kelp from Norway, with the view of encouraging the use of Scotch kelp, there being some manufactures—such as that of crown glass, for which the richer kelp, or barilla, is not suited. The Scotch makers having secured a monopoly, instead of setting to work to improve the article, as they might have done, attended only to quantity, and supplied the glass makers, who were in a manner obliged to use it with the veriest rubbish, thrown into the fused ashes, stones, sand, and all sorts of impurities, to make weight. In consequence, a glass manufacturer, using the same materials in regular proportions, could never calculate upon the quality of the glass he was to turn out. No two pots were ever alike —and, indeed, it was considered well to get half a dozen good tables out of the same pot consecutively. As soon as the repeal of the salt tax enabled the glass manufacturer to supply himself by its decomposition with an artificial alkali, upon which he could depend, the alkali manufacture commenced, and with it the great increase in the consumption of sulphur. When a supply of sulphur is derived from our own mines, it will render the alkali manufacture one of the most splendid triumphs of manufacturing skill and industry in the kingdom. In an alkali work much manual labour is required, and extensive premises, as most of the operation must go on under cover. Hence a number of the labouring population are employed, and there is a great consumption of building materials. In the manufacturing apparatus and utensils there is a great consumption of lead and iron. In one concern — that of Messrs. Tennants and Co., of Glasgow—without having very certain data to guide me, I should say that 1000 tons of sheet lead were slowly, but constantly, going to destruction —the first operation of alkali making being to manufacture sulphuric acid, which is done by burning sulphur, and condensing its va-

pour in large leaden chambers. In the construction of the furnaces, large quantities of iron, fire-bricks, &c., are consumed, while throughout all the operations, which are very destructive to the apparatus and utensils, an incredible quantity of iron is consumed. The grand basis is salt, which is first decomposed by sulphuric acid—afterwards by coal and lime, or chalk; very large quantities of coal are also used as fuel. The old name for soda was the mineral alkali—a very appropriate one, as it is altogether a mineral product.—*A Chemist—Mining Journal.*

AMERICAN PNEUMATIC ENGINE.

We had the pleasure yesterday of seeing the operation of a new engine for propelling rail-road cars, vessels, &c., just constructed in this city (Newark, U. S.) by Mr. Levi Bissell, the inventor. It is, we believe, the first attempt claiming to be successful, to use compressed atmospheric air as a motive power. The engine, which is constructed for the purpose of testing the practicability of the principle, is about the size of a five horse steam engine which it resembles externally, though its power is alleged to be much greater. A cylindrical iron chamber of the capacity of ten gallons is attached to the engine and filled with condensed air by a condensing pump. The air is conducted from this vessel to the working cylinder by a tube. Though the machinery, which is apparently very simple, is not yet entirely complete, it was put in operation twice while we were present, and certainly worked with great energy, until the power was exhausted.* In order to bring this power into practical use on railways, Mr. Bissell proposes to construct suitable pumps at convenient distances on the line of travel, with reservoirs capable of sustaining air condensed to 2,000 lbs. pressure to the square inch, from which the locomotive air chambers are to be supplied. The condensing apparatus, it is also said, may be so constructed as to be portable, and thus accompany the engine as a tender. Among the supposed advantages of this contrivance over the steam engine, the inventor alleges that the cost of the machinery will be much less, that it will be more durable, and far less exposed to derangements and accidents. The power, too, will be much less expensive, and at the same time more to be relied on. There are other advantages which, if the principle be practicable, will readily suggest themselves on a moment's reflection. Mr. Bissell hopes to be able to make a demonstration of the practicability of his invention on one of our rail roads or rivers during the course of the present season. That he may realize his most sanguine expectations, must certainly be the wish of every friend of improvement.—*Newark Advocate.*

* "Until the power was exhausted." That we can readily believe, but *when* was that? We see nothing in this account to induce us to expect better things of this engine than have been realized by any of the many other abortive contrivances of the same class.—Ed. M. M.

PASSAGE OF RAILWAY TRAINS OVER THE MENAI BRIDGE.

[From the Commissioners Report on the proposed Railway Communication between London and Dublin.]

From Penman Mawr the lines (of Mr. George Stephenson and Mr. Giles) follow a course in which there is not any essential difference until they reach the corner of Penrhyn Park.

Here Mr. Stephenson proposes to pass under the turnpike road; then over the river Ogwen, by a bridge 37 feet high, with embanked approaches, and afterwards through a cutting five-eighths of a mile long, and 45 feet deep.

The line then crosses the river Cagen and the valley through which it runs by a short viaduct, and an embankment 350 yards long, the extreme height of the former being 75 feet; this brings it to the ridge on the east-side of Bangor. By cutting a tunnel of 490 yards in length through this ridge the line would open on the Bangor valley, and pass Castle-street by a viaduct 35 feet high and 125 feet long. It would then cross the valley by an embankment and viaduct of a quarter of a mile in length, and of the extreme height of 70 feet. Mr. Stephenson proposes to pass through the hill of Penrhalt by cutting 1,000 yards in length and 17 feet in mean depth; and curving, with a moderate radius, to cross under the turnpike road and join the Menai bridge.

Mr. Giles, on proceeding from Penrhyn Park, recommends a more direct course than that of Mr. Stephenson, so as to bring his line nearly opposite to the end of the Menai bridge; but in adopting this plan, he would have to encounter very formidable difficulties, in the construction of two viaducts and two tunnels, one of the latter being one mile and a quarter, and the other three quarters of a mile in length.

The passage of the Menai bridge is the next point of importance. It has been supposed that this would have presented an insuperable obstacle to the lines of Messrs. Stephenson and Giles, but neither of these gentlemen proposes to cross the bridge with locomotive engines; the former suggesting

that the railway carriages may be drawn over by horses, and the latter by a stationary engine.

There seems to be no objection to either of these plans, and the loss of time consequent upon them would probably not exceed one quarter of an hour.

The following observations will show the sufficiency of the Menai bridge to sustain the weight of any number of railway carriages that may be required to pass over it.

In the first place, as far as regards the mode of passage, no important difficulty can be foreseen; the only question therefore, is one of strength.

The weight of a railway passenger-carriage with its load, is commonly estimated at about five tons, and the length occupied by each carriage, from one connecting pin to another, may be taken at 22 feet, when several carriages are in connexion. This would give a pressure of only ·23 of a ton per lineal foot on the length of the bridge, supposing the platform to be wholly filled with such carriages.

Let us now see what weight the bridge is capable of sustaining.

It appears from the statement of Mr. Provis,* who was the resident engineer during the erection of this splendid structure, that the suspended part between the piers consists—

	Tons.	cwt.
Of 16 main chains, including connecting plates, screws, bolts, &c. weighing	394	5
Of transverse ties	3	16½
And of suspended rods, platforms, &c.	245	13¾
The total weight being..	643	15

The distance between the points of suspension is 579 feet 10½ inches, and the deflection 43 feet. With these data, the tension in terms of the weight may be readily computed, from the properties of the catenary curve! but it will perhaps be more satisfactory to derive it from the actual experiments of Mr. Rhodes, who superintended the erection of the chains, and who found, practically, the tension to amount to 1·7 times the weight. This makes the tension on the supporting chains from the weight of the structure alone to amount to 1,094 tons.

Now to sustain this tension, we have a sectional area in the 16 chains of 260 square inches, which according to Mr. Barlow's experiments, made on the chain-cable testing machine at Woolwich, are capable of sustaining 2,600 tons, without injury to the elastic force of the iron, namely, 10 tons per square inch, the ultimate strength being 25 tons per square inch.*

	Tons.
If, then, from the absolute strength of the chains....	2,600
We deduct the strain due to the weight of the bridge	1,094
There remains a suplus strength of	1,506 tons.

which is competent, therefore, to sustain a uniform load (allowing the tension to be 1·7 times the weight) of $\frac{1506}{1\cdot7}$ or 886 tons. Now if the bridge were covered with loaded railway carriages on both sides, it would only be equivalent to 265 tons, leaving still a surplus strength of 621 tons. The objections, therefore, that have been raised respecting the capability of the bridge to bear the weight of the railway carriages which it might be required to support must be considered as utterly groundless.

Mr. Stephenson proposes to establish a station at each end of the bridge, where the locomotive engines would be kept in readiness to be attached to the trains.

ANCIENT QUERNS AND MODERN MILLS—ABSTRACT OF A PAPER READ BEFORE THE ROYAL IRISH ACADEMY. BY J. H. SMITH, ESQ.

[From the "Athenæum."]

The circular or rotatory quern, the parent of the modern millstones, is well known to antiquarians; but the still earlier and ruder hand-mill of an oblong form (and which, therefore, must have been used in a very slow and laborious process, by pushing the upper stone backwards and forwards upon the under), does not appear to have been hitherto noticed, being, in fact, very rarely met with; while the round quern is of comparatively common occurrence. The word "quern" comes directly from the Saxon or Teutonic name, with which it is identical. Another simple and domestic machine, the churn, derives its appellation doubtless, from the same root; the office of both being to *separate*—in the one instance, the meal from the husk, and in the other, the butter from the milk. It seems more than probable that the Latin verb "*cerno*," whose primary meaning is to *separate* or *divide*, took its rise from the operation of these very primitive implements of domestic economy. The approximation in sound will be apparent, if

* *See Mr. Provis's valuable work on the Construction of the Menai bridge.*

* Mr. Barlow's Report to the Directors of the London and Birmingham Railway.

we pronounce the Latin letter c hard, as some scholars maintain we should do. In the Celtic language the quern is denominated "Bró," and in the Welsh or British, "Breyan;" both words having the same origin as the old French verb "Broyer," from which we derive a verb not in very general use, but yet to be found in a work of standard authority, the English translation of the Scriptures, where, as it will be observed, it is met in conjunction with the operation of reducing corn to meal:—"Though thou shouldst *bray* a fool in a mortar among wheat with a pestle, yet will not his foolishness depart from him." One very ancient form of quern approaches nearly to the modern mortar, the under stone being a basin supported upon a tripod. The quern is also called in Irish *cloch-vron*, a term which occurs in the well-known Glossary of Cormac Mac Cuillenan, and has been translated to signify "the stone of sorrow," having allusion to the laborious and servile occupation which in ancient times grinding with it was generally esteemed to be. That such, however, was not always the case, appears from an anecdote quoted by Mr. Smith from Professor Tennant, respecting Pittacus, King of Mitylene, one of the seven wise men of Greece, who it seems "had been accustomed in moments of unoccupied langour to resort for amusement to the grinding-mill, that being, as he called it, his best gymnasium, or pleasantest exercise in smallest space." The memory of this fact is preserved in a song of the Grecian women, called the song of the mill, which began, "Grind mill, grind! even Pittacus, King of Mitylene, doth grind!" In illustration of the use of the quern at an early period, Mr. Smith cited a notice of it from an ancient Irish poem (extracted from the Memoir of Londonderry, accompanying the Ordnance Survey), by Cuain O'Lochain, who died, according to the Annals of Tighernach, in 1024; also an interesting Scandinavian legendary ballad called the Quern Song. That Shakspeare was acquainted with it appears from the allusion in his "Midsummer Night's Dream," where he speaks of the fairy Puck as labouring in the quern. Mr. Smith then briefly noticed a few of the many passages in Scripture referring to the hand-mill, some of which show it to have been common to the Egyptians and Philistines as well as the Jews. As to its use in modern times in Cyprus, Palestine, Hindostan, and generally throughout the East, he read passages from Shaw's and Clarke's Travels, and from the Journal of Mrs. Farrar, the wife of a missionary at Nassuck, near Bombay. He also noticed an *engraving* in Davis's China, representing a man working a large mill by means of a sort of handspike which he pushes backwards. Mr. Smith then read an extract from Pennant's Tour to the Hebrides, referring to the enactment in the reign of Alexander III. of Scotland (A.D. 1284) prohibiting the use of the quern, except during stress of weather, or in other cases of necessity; notwithstanding which, Pennant still found it there in 1772. In Sir Walter Scott's visit to the Orkneys in 1814, he saw the quern in the house of an old woman, who, practising the trade of a witch, subsisted by "selling winds" to the seamen of the neighbouring coast. And in the Shetland islands he noticed the rude adaptation of the quern stones to the purposes of a water-mill. From a curious book, entitled "The Montgomery Manuscripts," written about 1648, Mr. Smith quoted a description of a similar attempt in the Barony of Ardes, County of Down, in Ireland, to convert a hand-mill into one driven by water, in which "the axle stood upright, and the small stone or querns, such as are turned with hands, on the top thereof. The water-wheel was fixed at the lower end of the axle-tree, and did run horizontally among the water, a small force driving it." In conclusion, Mr. Smith pointed out the progressive improvement in the form of the quern—from the pair of rude oblong stones, which ground the corn by simple trituration, to the rotatory mortar-shaped quern; thence to the rounded or rather hemispherical form; and concluding with the two flattened stones, similar to those used in the water-mills of the present day.

TRANSFERS FROM COPPERPLATE TO ZINC OR STONE.

From the Transactions of the Society of Arts for 1839, Part II.

[*The Silver Isis Medal and Five Pounds were voted to Mr. R. Redman, 43, Great Wild-street, Lincoln's Inn Fields, for this Method of making Transfers from Copperplate Printing to Zinc or Stone.*]

The object aimed at by Mr. Redman is to make a transfer of copperplate engraving to zinc, retaining, at the same time, the whole, or nearly the whole, of its original sharpness and distinctness. The same process may be applied to making a re-transfer from stone to stone or zinc, and thus obtaining two or more plates of the same subject; which has been found to be a great advantage when a great number of impressions are required, or a smaller number in a shorter time than can be taken off from a single plate or stone.

The first part of the process consists in taking an impression from the copperplate in

the usual way, but with a peculiar ink, on transfer paper peculiarly prepared.

The composition of this ink, which he calls chemical ink, is as follows:—

3 oz. of shell lac;
1 — mastich;
1½ — yellow bees' wax;
½ — tallow;
4 — hard curd soap, and lamp-black enough to colour it.

The above ingredients are to be mixed together most intimately, and are then to be burnt in a pipkin for 10 minutes, stirring the mass carefully all the time. The residue by exposure to the air becomes damp; so that by pounding it in a mortar it concretes into a paste of a very stiff consistence, and in this state is called by Mr. Redman, *hard ink*.

One part of this hard ink, rubbed and ground with two parts of common stiff lithographic ink, forms the transfer ink; which being applied to the surface of an engraved copperplate in the usual way, gives an accurate impression to prepared transfer paper.

This latter is prepared as follows:—

One quarter of a pound of the best flour is to be mixed with common porter, in such proportion that it shall form, by boiling, a thin paste of a perfectly uniform consistence; which paste is to be laid quite evenly on the smooth surface of a sheet of India paper, and is to be dried gradually.

The impression being obtained on this prepared paper, is to be transferred in the usual way to a smooth plate of zinc. When the zinc has received the transferred impression, it is to be covered with an infusion of nut-galls, in the proportion of one ounce of galls to half a pint of water, the mixture to be then simmered for 10 minutes in any vessel not of iron. The liquor is to be left on the plate for from five to 10 minutes, its effect being to neutralise the alkali of the transfer ink, and thus to harden it and prevent it from spreading when sponged with water previous to printing from it.

Specimens of the ink, and of maps and other subjects transferred by Mr. Redman's process, were laid before the Society. Mr. Webb, lithographer, appeared personally before the committee, and stated that impressions transferred by the usual process to zincplate come off far sharper and better than from stone. He finds no difficulty in using Mr. Redman's ink for taking transfer impressions from copper. When a zincplate is laid by, after use, he sponges it over with the infusion of nut-galls, which protects it from oxidation by covering it with a brown film. On trying other inks in retransferring to stone, they sometimes fail—Mr. Redman's never does.

17, Gate-street, March 18, 1838.

Sir,—I beg to say, that R. Redman has occasionally made retransfers from copper to stone, and from stone to zinc, tolerably successful, and to my satisfaction; and that this mode is very useful with hurried jobs and long numbers. I am, sir, &c.

Wm. Day.

Lithographic Office, 3 Wellington-st., Strand. March 19, 1839.

Sir,—The system of re-transferring from copperplates to stone, &c., as practised by R. Redman, has been very successfully and beneficially used in my office; and where large numbers are required it is invaluable, as copies may be produced *ad infinitum* without the least injury to the original engraving.

E. F. Madeley.

NOTES AND NOTICES.

Preservation of Timber.—M. Boucherie proposes to effect this by introducing pyrolignite of iron by absorption into the tissue of the wood, immediately after the fall of the tree, or even while it is yet standing. This simple operation is said to be remarkably efficacious: 1st, in protecting the tree against rot, dry or humid; 2nd, in increasing its hardness; 3rd, in developing and preserving its flexibility and elasticity; 4th, in preventing the cracks which result from variations of the atmosphere when brought into use; 5th, in reducing its inflammable and combustible characters, and 6th, in giving it colours and odours at once varied and enduring.—*Athenæum.*

Sliding Keels.—To get rid of the disadvantages under which iron steamers usually labour from their small draught of water, an expedient has lately been adapted in the *Nemesis* iron steamer of 700 tons, which seems likely to answer well. She has been fitted with two sliding keels of wood, 4½ inches thick, and 7 feet long, capable of being protruded 5 feet below the vessel, which work up and down by means of a small windlass and endless chain in a water-tight case 12 inches wide, formed of sheet-iron and running from the bottom of the vessel to the deck. The advantages derived from these keels when under sail, are keeping the vessel to windward and rendering her steady. One is placed just before and the other just behind the engine-room. There is also a contrivance by which the depth of the rudder in the water may be increased according to the depth of the keels.—*United Service Journal.*

Metropolis Roads.—By the Report of the Commissioners of the Metropolis Turnpike Roads, north of the Thames, for the year ending the 25th of March, 1840, it appears that the roads generally are in a good travelling condition, but that extra quantities of mrterial have been provided for some of the lines on account of the late inclement season. The commissioners report, that with economy, they have been able to fulfil all their engagements, and to pay off the seventh instalment of 5,000*l.*, together with interest on their mortgage debt, which is now reduced to 65,000*l.* During the last year the receipt from tolls was 74,339*l.* 6*s.*, the total receipt from all sources of income 76,582*l.* 15*s.* 7*d.*, and the expenditure 78,242*l.* 10*s.* 10*d.*, including the 5,000*l.* employed in the reduction of the debt.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 877.] SATURDAY, MAY 30, 1840. [Price 3*d*.

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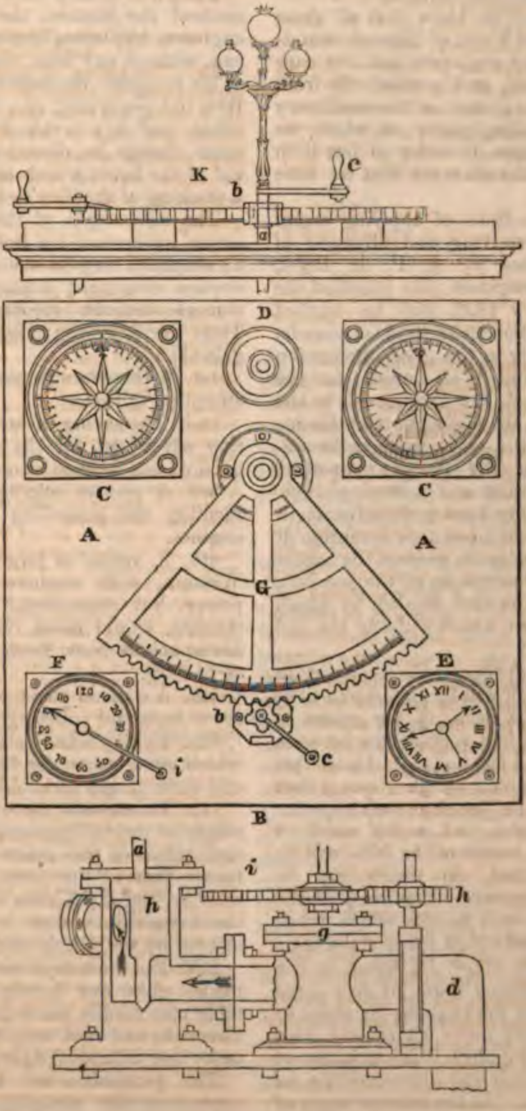
RIGEL'S PATENT APPARATUS FOR STEERING STEAM BOATS.



CHEVALIER RIGEL'S PATENT APPARATUS FOR STEERING A STEAM BOAT WITHOUT A RUDDER.

[Communicated by the Inventor.]

The public is sufficiently acquainted with all the accidents which have happened since the application of steam to navigation; therefore it will be unnecessary to enumerate them here. Nevertheless it is well to know that all these evils arise from a sort of misunderstanding between the engineers and the captains of vessels, and particularly from the faulty arrangement of the machinery and the propelling power, of which we can freely dispose, in order to put it in opposition to the elements that we have to encounter.

The new method of applying steam force to the steering and directing of vessels invented by A. P. de Rigel, architect and engineer, and patented the 14th October, 1837, may be applied without exception to all kinds of vessels, and particularly to the great navigation of the East and West Indies; for the larger the vessel, the greater will be the advantages of the application of this invention, and the more marked the improvement on the present imperfect manner of steering and governing ships.

Before making known the advantages which will result from this invention it may not be useless to present the reader with a short description of the machine itself, and of the easy manner by which one may steer a vessel without the aid of the rudder.

The inventor proposes the construction of a table, which will be placed in a little pavilion on the deck, in the centre of the vessel, and in a vertical line between the engines and the boilers. Upon this square table, which will be about 4 feet diameter, will be placed at each superior angle a compass, and in the middle a lamp. In the centre of the table will be placed a sextant, on which will be marked the degrees of the force of the engines, and by a handle which turns this sextant, and which opens at the same time a valve, to allow the steam in the cylinders to escape, more or less force can be given to the engines, in order to make the wheels move alternately with more or less rapidity, independently of each other, which will give the ship an *oblique course*. In the inferior angle of the table to the right, will be placed a chronometer, and to the left a dial, on which will likewise be marked the degrees of force of the steam, and with a handle which turns this dial, a valve placed in the generator can be opened or shut, in order to give the vessel a speed more or less accelerated, or to stop it altogether.

Thus it is clearly shown, that by this method the captain, the pilot, or the engineer, by placing himself at this table, can, without any help, direct the vessel at his pleasure, by making the paddles turn independently, one faster than the other, and it is evident that the boat must change its direction without the aid of the helm, which always produces a slacking of the ship's speed.

The advantages of this invention to steam navigation are immense, because all obstacles may be overcome, and the voyage continued under any circumstances without stoppage or delay. Thus the following advantages will be gained:

1st. A considerable saving in the consumption of fuel.

2nd. The saving of fuel presents another advantage, for the space it would occupy, can be filled by merchandize, &c.

3rd. A greater celerity without augmenting the propelling power of the engines.

4th. A vessel as large as the Great Western, with engines of the same power, but constructed after the new manner, would make the voyage from Liverpool to New York, in 10, instead of 14 days.

5th. A quicker passage would abridge the tedium and sufferings of the voyage.

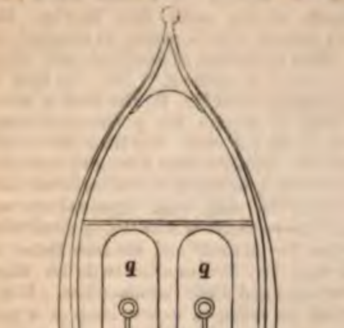
6th. By a quicker passage, tempests, which often cause the loss of the vessel and crew, might be avoided.

7th. In tempests, three different forces might be put in opposition to the wind and tides—if the masts are lost, two forces that of the helm and also the paddles, and if the helm be likewise lost, the vessels may then be equally well steered by the wheels alone.

8th. The most rapid evolution can be made, since one person placed at the table can readily steer the ship in any direction, and even stop it with promptitude, and without fatigue.

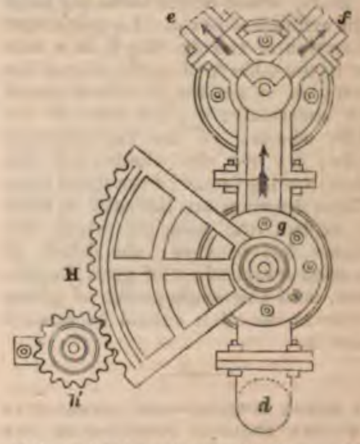
The profession will know how to appreciate this advantage, particularly

on entering or quitting harbours, which always present obstacles and dangers.



In order to give a just idea of the necessity of applying this improvement to steam navigation as soon as possible, I will give the following illustration.

If the driver of a four-horse coach had conceived the strange idea of confiding the conduct of his horses to four grooms, and in the course of his journey was obliged to cry to each of the grooms "to the right," "to the left," "quicker," or "stop," instead of performing these manoeuvres with his own hands every body would say that the coachman was mad, and certainly would not travel with him for fear of being retarded or overturned. Yet the same thing is done every day before our eyes, when we see beautiful vessels, costly merchandize, and valuable lives confided to so imperfect and faulty a manner of steering as that now in use.



It is to be hoped that the Steam Navigation Companies and engineers, engaged in the construction of steam vessels, will avail themselves of this invention, and will not delay acquiring the information requisite for rectifying an evil too dangerous and glaring to be much longer endured.

Description of the Engravings.

A is a table, proposed to be constructed nearly in the centre of the vessel, under shelter; B place for the captain; C C two mariner's compasses; D lamp for night use; E a chronometer on the right of the captain; F a dial on the left of the captain, put in action by the supply of steam to the cylinders; G a strong metallic sextant turning on the centre *a*, the cogged edge of which is proposed to be moved by the small rack wheel *b*, which is turned by the handle *c*; H machinery proposed to be placed under the table A. *d* is the generator, conveying the whole of the steam from the boilers. *e* and *f* are lateral branches, distributing the steam between the cylinders on either side; *g* is the top of a cylindrical box, containing a valve, which opens or closes the generator; *h* is a valve, which directs the supply of steam to the cylinders on one side or the other, or allows its passage equally to both; these two valves are opened or shut at pleasure on the surface of the table A, by the two handles *e* and *i*. The valve in the interior of the cylin-

drical box *g*, is opened or shut by the handle *i*, which turns the rack wheel *k*, (see figs. H and I,) and thus moves the sextant G, whose centre turns the valve in the cylindrical box *g*. I is a side view and section of the fig. H; K is a side view of the table A; L is the plan of the vessel; *m m* are the cylinders which work alternately; *n n* the axles of the paddle wheels; *o o* are the plummer blocks; *p p* are the wheels; *q q* the boilers; *r* is the funnel; *s* the steam pipe.

These drawings are intended to shew and explain the principle which the inventor has in view; the details of execution would admit of great modification, and the employment of pieces already in use, if it should be deemed desirable.

THE PENNY POSTAGE—THE GOVERNMENT STAMPS SELLING TWENTY-FIVE PER CENT. UNDER PRIME COST!

How that which costs at Somerset House a full penny, can be sold at the shops at three-farthings, and with a profit to the vendor too, is *certes*, a riddle well worth unriddling. Are the stamps stolen? Are they forged? Or has some leviathan dealer in "stamps" and stationery made a "grand smash!" and are his assignees selling-off for the sake of ready cash and a speedy winding-up, at an "unprecedented sacrifice"? No gentle reader, nothing of the kind. Neither theft, nor forgery, nor desperate insolvency. The stamps are genuine stamps, and sold on no principle but a cool and deliberate calculation of profit, at 25 per cent. less than they cost! Your surprise at this doubtless is great; so was ours at first; but the thing as you will find admits of a very simple explanation. Instead, however, of giving that explanation in our own words, we shall leave the ingenious author of this new system of making gain out of loss, to speak for himself. On the 6th of May we received from him the following note:

"Sir,—Allow me to hand you a Specimen of the interior of a NEW POSTAGE COVER, of which I can obtain for you a supply at THREE FARTHINGS each.—No charge for Paper.—Not less than a Quarter of a Ream, or, 240 Covers for FIFTEEN SHILLINGS, Money, can be supplied at this proportionate price.

"Your obedient Servant,

"J. C. BOWLES."

"*80, Cannon Street,*
5 May, 1840."

The "specimen of the interior," inclosed in the above circular, consists merely of an *advertisement* of another clever contrivance of the same Mr. Bowles, the DATE BOXES, now becoming so common to all offices and places of business, and which none should be without.* For the sake of this *advertisement* Mr. Bowles finds it worth his while to furnish the government stamp cover at 25 per cent. less than the prime cost; he calculates that a farthing expended in advertising in this way, will be better laid out, than the same sum expended on any other known mode of advertising; and what he does for himself and his Date Boxes in this way, Mr. Bowles offers to do for other advertisers and their commodities. Has a person, for example, a new lamp or a new stove to bring under the notice of the public, he has only to supply a brief description of it to Mr. Bowles, who will print it on the inside of any number of envelopes which may be agreed upon, for such a sum as will cover the expense of paper and printing, and the 25 per cent. deduction from the cost of the stamp. The subsequent sale of such envelopes to the retail dealers, at 25 *per cent.* under the government price, is of course a matter of no difficulty; and is done either through the medium of Mr. Bowles (in the way exemplified by his circular before quoted), or by the parties adopting this cheap mode of advertising themselves.

MR. HALL'S CONDENSERS AND THE "BRITISH QUEEN" VACUUM.

Sir,—The log of the British Queen, that glorious sea bird whose wings have been so cruelly clipt, has just come to hand, with the subsequent numbers of your instructive Magazine. I have been much struck with the spirit of fairness which, like some purifying river, runs through them, giving out a freshness and vigour truly delightful in itself, and more so *by contrast*. Though hitherto I cannot be classed among those saucy fellows, the "Jacks, Toms, or Harrys," the "A's, B's, or C's," that seem to rouse Mr. Peterson's ire, inasmuch as I have not before addressed you; yet there is so much good sense in your note, anent the same that I do not hesitate,—*malgré*, that gentleman's virtu-

* By these boxes, which, like clocks, are usually fixed in some conspicuous place, the day of the month can be instantly seen from most positions in a counting house or office, without the constant trouble of reference as formerly, to pocket books and calendars.

ous indignation against the "fictitious signatures which at once shew that the writers were either prejudiced, interested, or else entirely ignorant"—to enrol myself among these vigorous and useful pioneers of the march of TRUTH.

Permit me first as "a new" and I trust not less "modest" correspondent than Mr. Peterson, to hope, that for example's sake, you will not allow any editorial feeling of modesty to exclude an open and just expression of admiration, that you do not, as many who conduct magazines, permit private acquaintance to interfere with impartiality to the public. You candidly admit, Sir, at p. 705, that you have the pleasure of knowing Mr. Hall, and highly respect that gentleman, and yet with much fairness you correct "an unintentional injustice" done by yourself to Mr. Holebrook, and clearly show that Mr. Hall,—no doubt

——————— "with the best
"Intentions, but his treatment was not kind;"

has borrowed, (far be it from me to say stolen), from the former, the principle of his invention, and upon which he seems to have laid his hand with all the unsuspecting and interesting innocence of the immaculate Donna Julia—of course,

"Quite by mistake—he thought it was his own."

I know neither of these gentlemen, and shall carefully abstain from introducing into my observations a single name with which I have the slightest personal acquaintance. I have made the above remarks because the creditable nature of your article on Mr. Holbrook's patent leads me to believe, that the editor of a journal so respectably conducted, will not exclude what may be for public benefit,—an impartial unprejudiced investigation of Mr. Hall's condensers,—simply because you "have the pleasure of his acquaintance and highly respect him."

I shall do Mr. Hall the justice to admit that I have never read of any invention having more unexceptionable testimonials in its favour. I *know* that Mr. Beale, Mr. Pym, and Mr. Twigg, three of the directors of the St. George's Company, refused to become directors of the British and American Steam Company, unless Mr. Hall's condensers were applied to the British Queen, and the other vessels the company might build. I have read also, with surprise I must confess, the powerful and numerous certificates from highly respectable persons (*engineers* they call themselves) speaking of his condensers in the highest terms. I doubt not at all the honesty of these certificates, for the invention may have worked well enough at the time they were given, when the machinery came quite fresh from the maker's hands; but, I do very much doubt the continued working of so much complicated machinery, and particularly I deny the correctness of the inference Mr. Hall declares they warrant. I think, therefore, Sir, that you will agree with me that it becomes a not uninteresting subject for public "investigation," especially as it is a challenge Mr. Hall has at all times thrown out, how far this plan is the *rara avis* it is stated by its inventor to be, and how far such certificates are to be relied upon as correct evidence of its real and permanent, not apparent or temporary, advantage. Clearly the plan is either—to use the confident assertion of Messrs. Lloyd and Kingston, the government engineers, (who holding up their tapers to the glorious sun persuade themselves that their glimmering rushlights will eclipse the broad flood light of human knowledge, when they thus arrogantly venture to set a limit to man's intellect,) "so successful as to leave nothing to be wished for," and is therefore deservedly entitled to universal adoption; or else, notwithstanding all these high and flaunting authorities, it is one of the grossest, and most costly delusions, ever attempted, by the strength of many names, to be crammed down the capacious swallows of a pensive and gaping public. If too it *should* perchance appear that nature cannot be persuaded to alter her laws to confirm the dicta of these intelligent gentlemen, and "leave nothing to be wished for;" and that the principles of steam condensation declare with unerring certainty, that "the steady vacuum of 30½" must be only a "steady" quackery, we shall then learn how far the three aforesaid directors were justified, being neither practical nor scientific men, to take upon themselves the heavy responsibility of making the adoption of Hall's condensers in the British Queen a *sine quâ non*, and giving to that fine proportioned vessel the enviable and time sticking patronymic of "the slow coach." We shall see also how far they are justly chargeable to the respectable proprietary of the British and American Steam Navigation Company for the enormous unnecessary expense incurred, by the delay and in burthening the Queen with 30 or 35 tons addition to her machinery, an expense which *I* know was at least one-third of the whole sum paid for the engines; and for the loss of interest upon which at £5 per cent., "the extraordinary vacuum of 30½" is, I assure you, no consolation to the shareholders. I shall first investigate the principle of condensation, then shew its application.

There are only two methods of performing the distinguishing characteristic of the low

pressure or condensing engine, and upon the rapidity of effecting which entirely depends its available duty. 1st., condensation by the usual injection, and 2ndly., condensation by surface, not invented, but drawn from the dark ages of the steam-engine, by Mr. Hall, to astonish the scientific world of the 19th century. As regards the first mode there is only one disadvantage for marine engines, which is, that by the use of the external water the boilers become encrusted, require frequent chipping, and last only 4, 5, or 6 years: a greater consumption of fuel is also necessary on account of this encrustation being a bad conductor of heat, and to provide for blowing out. But we have to do chiefly with the principle of the two, for it is the principle of the old plan, of Mr. Watt's adoption, that is so much abused. It is, however, notwithstanding all the twaddle about choking condensers, the most perfect, producing the most efficient vacuum, though nothing like the "steady extraordinary vacuum" of your considerate and modest correspondent, Mr. Peterson, render it truly "unrivalled by any engine or engines in the world." As regards the second named plan, its disadvantages are "legion," and I hope to show that the vacuum of 27 or 28 produced by the former is infinitely superior to the "steady Peterson vacuum" of 30½ obtained by the latter, though a vacuum is a vacuum certainly, and facts (query truths) are stubborn things.

Before we contest the accuracy, or in this case the value, of experiments, and especially where they startle us from our propriety, we must understand the laws which regulate their action. The correct deductions of the exact sciences have enabled a Newton to foretell the bases of the diamond and water to be the same long before the means were found to verify the prediction,—and many are the instances recorded where the same processes have detected the fallacy of experiments, and corrected their errors. Now the object of condensing the steam is, to prevent its elasticity retarding, as would a powerful spring, the ascent or descent of the piston, on the moment that its action is reversed. It follows, therefore, that to obtain from any given engine the greatest amount of power it is capable of giving,—and in these days of rivalry nothing less will suffice, for the power must be taxed to the uttermost, and every thing that science and capital can command must be judiciously united to produce a crack vessel—it becomes necessary to employ those means which a long experience has confirmed will reduce, *the most* instantaneously, the useless steam *into the* temperature of resistless water. Upon this lightning-like process, and the immediate withdrawal of any uncondensed steam from the opposite side of the piston to which the steam is acting, depend the utmost effective duty of the engine. In order, therefore, that the piston might be relieved from any uncondensed steam as quickly as it was possible to relieve it, Mr. Watt, with his usual unerring perception always placed his air-pump in as close connection with the cylinder as he could arrange the parts. Certainly in these matters he is not at least inferior, as an authority, either to Mr. Hall, or to the engineer of the British Queen, whose "extraordinary vacuum," "so perfect past all parallel," would doubtless shame the paltry vacuum of the unpretending Watt. Yet this great man tried both plans, that by injection, and that by surface condensation. When once an idea entered his mind he never left it until he had followed it out in all its remotest bearings, and exhausted it. If there *was* any kernel to extract, he got at it; if not, he dismissed the rubbish from his vast mind, and satisfied that he was not wont to give up an experiment without thorough investigation, he never afterwards troubled himself any more about it. By acting always upon this plan he left a machine which has raised his country to an unexpected pitch of greatness, and is the admiration and envy of nations. And what does such an authority say respecting the two plans? In April, 1776, he writes to Smeaton: "I have made considerable alteration in our engine lately, particularly in the condenser; that which I used at first was liable to be impaired from encrustation from bad water; therefore we have substituted one which works by an injection. In pursuing this idea I have tried several kinds and have at last come to one which I AM NOT INCLINED TO ALTER .... THE INJECTION OPERATES BEYOND MY IDEAS IN POINT OF QUICKNESS AND PERFECTION." Now, sir, I must own that I feel that reverence for the genius of Mr. Watt, in common, I doubt not with millions, that I cannot bear to see one ray of his glory diminished by his successors. I am not indeed so silly as to infer that no improvement can be made in those parts of the steam-engine to which Mr. Watt did not think it worth any useful purpose to direct his attention; but, I *am* silly enough to believe, after reading M. Arago's life of this "wonderful" man, as he is justly termed, that no improvement has yet been made in any thing he had particularly investigated; more especially in the principle of condensation, a subject to which his genius was for a long time devoted, and on which we have

seen he made many experiments. His mind, indeed, in every thing connected with the steam-engine, was one vast mausoleum of knowledge—a very pyramid, descending unchangeable to all time. Are we not then justified in assuming at the outset, without *any* further inquiry, that when the greatest master of the steam-engine, whose principles were the children of his thoughts; the investigator with Dr. Black of latent heat, an intimate acquaintance with which directed him in his researches, and is closely connected with surface condensation; when *he* abandoned this plan as worthless, we who follow tottering in his footsteps, and seek in vain the heights he trod, may with confidence assume that it *must* have some inherent defects—can we as reasonable men suppose that if an honest efficient cylinder vacuum of 30½ was to be obtained by surface condensation, that Mr. Watt would not in his numerous experiments have obtained it, as well as Mr. Hall; and that if obtained he would have thrown it aside for one of 27 and 28? Or is it reasonable that posterity would have confirmed, for nearly a century, the superiority of the principle of injection, thereby consolidating the soundness of Mr. Watt's judgment? All reason is against it, and yet we are now told in substance that a Watt knew nothing of the subject, and are asked to pin our faith upon the evidence of these authorities in favour of the superiority of surface condensation in opposition to one of the most powerful intellects of all time.

Here, sir, I might fairly stop, but as it would be thrown in my teeth that a vacuum of 30½ is still a vacuum of 30½, we can only wonder how the devil it got there, unless some light can be thrown upon the manner in which it does get there. First let me ask, can any one acquainted with the nature of steam really belive that this vacuum is an efficient vacuum under the piston of 30½, obtained too, by surface condensation in the *same time* as by injection? Can they really believe that steam is so rapidly absorbed by pipes of half an inch diameter, as by having sprays of cold water dashed amongst it, acting upon it as does fire upon gunpowder, and bringing the whole volume into water with the rapidity of an explosion? Do they not know that the quicker this is performed, and the steam is removed from the piston, the greater duty is obtained from an engine, and that a *very trifling* difference in *time* makes a *very great* difference in the available power?

Having thus explained the principle of condensation, let us see whether either of these essentials to the utmost duty of an engine, viz. the instantaneous reduction or absorption of the steam, and its immediate removal from the cylinder, can by the means employed by Mr. Hall, by any possibility equal Mr. Watt's plan; and we shall then find that the former not only does not gain "a very considerable increase of power" as insisted upon by Mr. Hall, but in fact *must* lose it by the slowness of the process.

I admit at once that Mr. Hall's plan prevents the incrustation of the boilers, and thereby saves them; but it does appear to me that it effects this at so much expense, at so great an expenditure of power that would otherwise be available to the paddles, and by so much complicated machinery liable to derangement, as to render the remedy about equal to the disease, if not worse, and consequently that the outlay for this ponderous space—economising apparatus is a waste of money.

The following are the exact dimensions of this invaluable invention which is "so successful as to leave nothing to be wished for," that they are particularly deserving of attention when space for long voyages, and saving of tonnage, and complexity of machinery, are no objects to Messrs. Beale, Twigg, and Pim. I select the *British Queen* and *India* to gratify the lovers of country made engines because they are their own pets.

	British Queen, 500 *h.p.*	*India*, 350 *h.p.*
Diameter of cylinder,	77½ inches	63 inches
Hall's condensers, each	77½ inches square and 12 feet high	63 do. exact shape and size of cylinders. 7 feet 1 in. high
Miles of half inch pipes in the two condensers	14*	9
No. of joints in ditto	14,000*	9,000
Two extra force pumps to supply the condensers	area 22½ by 17½ and 3 ft. 8 stroke	area 18 in. diameter stroke 3 ft. 10 in.
Revolutions	14½ and 18 when light	not given
Vacuum	30½	29½
Stroke	7 feet	5 feet 9

* *No mistake, I assure you—fourteen miles of pipes, and fourteen thousand joints. Nice em-*

When you look at the enormous mass of machinery in these two vessels, and see, instead of two cylinders, what amounts to four, with all the concomitants of extra pumps, &c., the poor engine groaning like some over-loaded beast; and when it is observed the manner in which the whole is arranged, you cease to wonder either at the Queen earning the enviable title of the "The Slow Coach," or that the India is still rotting unemployed. As regards the last indeed, I should not be surprised, if we hear some day, that the vacuum stands steadily at 34 or 36, and thus outqueen's "The British Queen Vacuum," inasmuch as her condenser and air pump are very ingeniously arranged to get a good vacuum, being about double the distance from the cylinders of those of the Queen, and both about three times further from them, than the air pumps and condensers of Mr. Watt's injection engines. Is it surprising then to find 29½ and 30½ vacuums at that part nearest to the air pump, when the condensement has to travel through some thousands of interesting little tubes before it gets to the air pumps? Is any one however silly enough to suppose that any thing like this vacuum is steadily obtained under the piston, or at the top of these thousand jointed condensers? Is it possible for the air pumps to sweep off their contents, at each stroke, throughout the whole space from the piston, (fifteen feet) 3,500 tubes of 9 feet, in *the same time* as they sweep the one undivided space of the common condensers, three times nearer to the piston? When I can bring my mind to believe that steam can be condensed by surface as instantaneously as by injection, and can be withdrawn from such a multitude of pipes of half an inch in diameter with the same rapidity as from an unobstructing condenser three times closer to the moving power, I will then admit that the "steady vacuum of 30½" is an *efficient* one, but not before. And when the effective duty of the steam engine does not depend upon these essentials, I will give up condensation by injection, and Mr. Watt as my authority. Mr. Hall's condensers, &c., will no doubt effect condensation *in time*, but what is the piston about whilst this is doing? and at what part of the stroke is it when it is done? Let us suppose for instance, that the piston is just upon the point of reversing its action; open flies the communication with the thousand tubed condensers, away rushes the steam; but instead of being on the instant annihilated by an injection, (like a large crowd seeking entrance through a narrow door-way,) the whole of the steam cannot get down these pipes at once, and meeting with no water to reduce its elasticity, there it must wait at the top, which is close to the piston, until the previous portion is condensed. The impatient piston, however, stays not until the condensation is wholly effected; down it comes on the moment, but with force diminished in proportion to the quantity of uncondensed steam resisting its action on the other side, and consequently with nothing like its full effective power. And yet Mr. Peterson, as an engineer, ventures to challenge the world to match "*above all the high state of* PERFECTION in which the engines perform their DUTY."* In the mean time, however, the air pump being some 15 feet from the piston, and unable entirely to exhaust 3,500 tubes of 9 feet in 2 seconds, has taken out all it could get hold of; the steam at the top of the condensers very cunningly refusing to come down until the portion at the bottom of the pipes is drawn away, and "the Peterson vacuum" is shown off; and thus it is exhibited to the admiring gaze of all the advocates of the superiority of Hall's condensers, who exclaim, splendid engines! what a vacuum! "The *great increase of power* derived from the use of the patent condensers is *therefore self-evident!*" as the intelligent Mr. Peterson conclusively observes; though it appears that in other engines fitted with these said condensers "the same successful results" were not quite so "self-evident," except indeed, when under his charge. This gentleman certainly expresses his "firm belief that if all the vessels in which his (Mr. Hall's) condensers were fitted *had been properly managed* and understood, the same successful results would have been the consequence." I, for one, do not doubt it. This is an unfortunate admission, however, for the value of the invention of it clearly shows that it requires far more "*management*" to make it answer than engineers have time to bestow upon it. It was a *lucky* coincidence for Mr. Hall *to find* on board the Queen, the very engineer who had "managed" so well his condensers in the Megæra. But admitting that "the same successful results" that is, I suppose, a vacuum of 30½, is always obtained; no notice seems to be taken of the two formidable looking force pumps. These weigh somewhere about 3 tons, with cylinders and length of stroke of dimensions equal to about 15 horses power; and which are necessary to supply the tanks, thus throwing an additional burthen upon the engine. Now as an injection engine of 500

ployment for the engineers to keep joints tight *when they* have nothing else to do; and no fear of *derangement* from expansion and contraction, which *at 15 revolutions* a minute takes place alternately *every second!*

* See Mr. Watt's explanation of the term duty.

horses power requires somewhere about 3,000 gallons of water a minute, these tubular condensers must require more than that quantity in the same time; so that every minute at least 4,000 gallons of water must be pumped in, and pumped out of these enormous tanks, for no other arrangement than force will suffice to change the water in that time, and unless changed, the pipes will get too hot to condense at all. "The *great increase of power* derived from the use of the patent condensers *is therefore self-evident*," as the ingenious Mr. Peterson so clearly makes out; as evident as those misbegotten knaves in Kendal Green, who kept Honest Jack at swords point for one full hour by Shrewsbury clock, when seven of the eleven he paid. "Oh, monstrous, leave him alone, we shall have more anon." To my poor comprehension, however, though doubtless, I must even be content to be classed among "the prejudiced, interested, or ignorant," a more efficient, because more entire piston vacuum of 26, 27, or 28, will be produced by an injection in *one third* less time than the "steady vacuum of 30½" by surface, and as all the appurtenances of thousands of joints, miles of pipes, force pumps, ponderous condensers, tonnage space, and all those funny "self-evident" means of increasing the power will be saved, I think I have made out that the former vacuum gives a very superior effective power to the engine over the "British Queen Vacuum."

The *Mechanics Magazine* is, I consider, pledged by its name to convey to the people *sound* and useful knowledge. If then Mr. Hall's plan of condensation is the soundest in principle, and an efficient piston vacuum of 30½ is obtained in the same time as by injection, Mr. Watt was clearly wrong in giving such the preference, and we can no longer regard or quote him as an authority. In his place we must substitute Mr. Hall, unlearn all we have been taught of the nature of steam, and go back again to the days of Savery and Newcomen. Having, however, rescued, I hope the genius of Mr. Watt from all suspicion that he had tried a method of condensation which he threw by, because he could not succeed, I take my leave under the impression that surface condensation will soon be quietly buried where this great man left it. I have been purposely thus diffuse that I might make this stale disused principle comprehended by non-professional readers, that Mr. Watt's simple and admirably arranged engines might not be mercilessly altered to complexity, (entailing a loss of power,) by those who are not fit to wear his shoes. I know not if I have gone over any of the ground of those anonymous writers, who induced Mr. Peterson so chivalrously to come from his retirement, "proud to acknowledge himself the known advocate of this unrivalled invention." I hope, however, that those scientific directors aforesaid, will pause, and require some other test of the effective duty of the engines than a mere vacuum of 30½ so obtained, before they *insist* upon burthening the President with a similar clog; for though it does produce "an extraordinary vacuum" it is hardly worth the many thousands it has cost the shareholders. I was confidently told that the patent condensers were to be applied to this vessel; I therefore, cry out, "*Caveat emptor*."

And remain, Sir,
Your very obedient servant,
SCALPEL.

Dublin, May 18, 1840.

TREDGOLD'S FORMULA FOR CALCULATION OF STEAM POWER.

Sir,—It is incumbent on me to correct an error in my last week's letter with regard to the amount of reduction made by Tredgold for waste, &c., in his rule for non-condensing engines. I find upon a closer consideration of his words, that the $\frac{4}{10}$ were intended for the *total* pressure in the boiler, and not as I was at first disposed to imagine, only the *excess above atmosphere*. This, I confess, I might have detected at the time from the terms of the equivalent expression $(\phi + 11.5) . 6 - 11.5$. Yet the latter interpretation, was in some measure encouraged by the tenor of the preceding portion of the article and the rather vague manner in which the whole rule is expressed.

However, this correction neither affects Tredgold's formula as it stands, nor the explanation of it I have given. It obviously but strengthens the general objections against his mode of calculation, and renders M. de Pambour's conclusions perfectly valid, viz.: that by it, an engine with a *working* power of 100 horses would require 40 horses to balance the friction of the piston alone, and 12 more to overcome that of the other parts!

INDICUS.

May 25, 1840.

A few words of final explanation, and the discussion between "Indicus" and myself will have ended as amicably as it began; certainly not without advantage, since it has elicited from him the copious exposition of the subject contained in your last number. I find, upon examination, that the two formulæ are, as "Indicus" states, precisely the same except in form: but I must say, that the shape in which the rule is presented by "Galloway," appears to me to be infini-

tely more intelligible, and consonant to common sense, than its original form in Tredgold.

I certainly have not the advantage of being a practical person, but with respect to my having chosen the fraction ·536 (which, it must be remembered, is as much Tredgold's as ·6) I was led into the error, if error it be, by finding it stated in my authority that it is decidedly advantageous to work high-pressure engines expansively; taking it for granted, therefore, (in the absence of information to the contrary in "Indicus's" first letter,) that this advantageous method would of course be adopted in the engine he referred to, I naturally made use of Tredgold's multiplier when the steam is cut off at ⅔ds of the stroke, viz.: ·536. Vide "Galloway's History of the Steam Engine" (1830), p. 462.

Nothing can more clearly show the fallacy of any comparison between power and performance, where the calculation must necessarily be based upon such extremely uncertain data.

NAUTILUS.

May 25, 1840.

SUPPLY OF WATER TO THE METROPOLIS.

A Select Committee of the House of Lords having, on the motion of the Marquis of Westminster, been appointed to institute a new inquiry into the often agitated question of the supply of pure water to the metropolis, the press is once more lending its powerful aid to the diffusion of correct information, and just views on the subject. A pamphlet is now before us,* (from the pen, we believe of Mr. Peppercorne, the surveyor,) which, if we mistake not, will be found to anticipate all that the committee can with truth report about it; and this in brief may be described to amount to this,—that the people of London are a vast deal better off than they have any idea of, and need only to make a proper use of the plentiful supply, which nature has brought to their doors, to be without the slightest cause for murmur or complaint.

The inclination of the popular mind at the present moment, is to a strong belief, that much purer supplies of water can be obtained from rivers or springs at a distance from the metropolis (to which they are to be brought by long and expensive aqueducts), than from the Thames, at any part of its course, whether high up, alongside, or low down. Now the object of the author of this pamphlet is to shew that this is a mere whim, without any rational foundation, and that Thames water, provided always, it is put through the same process of filtration, which all water employed for table or culinary purposes ought to be put, is the very purest and best that can any where be obtained. And this object he has we think, very successfully accomplished.

First, as to the grievous charges brought against good "Old Father Thames," behold into what mere straws on the surface they are turned, by the hand of an impartial and discriminating investigator!

"It has been the fashion for some years past to descry the use of Thames water taken from the London district, as being not only totally unfit for domestic purposes, but even prejudicial to the health of those who make daily use of it as a beverage; some writers have even asserted that many of the diseases with which the inhabitants of the metropolis are afflicted, are to be attributed to the daily use of this baneful liquid, which, according to them, so far from being a blessing, is, on the contrary, one of the greatest curses that could have been inflicted upon us.

"Thames water has been described, by these alarmists, as a "villainous compound," made up of all that is most nauseous and filthy in nature, in such a state of solution and chemical combination that no process of filtration or purification can render it salubrious or even potable. It has even been said that the very fishes have abjured their native element, when they have arrived in the vicinity of London, and have actually been seen *to leap out of the water*, on to pieces of *floating wood, bundles of weeds*, &c., or whatever happened to be most convenient, in order, no doubt, to escape from the hated element, and to breathe *pure air!*" (See evidence of some of the witnesses examined before a Committee of the House of Commons in 1828, pages 69 and 70.*)

"It has been further stated that no part, or if any, but a very small portion, of the

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* "A Brief Description of the Various Plans that have been proposed for supplying the Metropolis with pure water. Also a short account of the *different* water companies that now supply *London.*" *Illustrated* by several wood-cuts, descriptive of different processes of filtering. London. *Weale*, pp. 88.

* "'I have seen the flounders,' says Thomas Hatherill, 'put up their heads *above the water*, and if there was a bundle of weeds in the river, they would get on it out of the water!!!'" (See Minutes of Evidence, 1828, page 70.)

impurities which pass into the Thames, is carried by the action of the tide to the sea, but that the whole is in a constant state of "oscillation" to and fro near the metropolis; that the impurities, in fact, are carried as far down the river as the tide will carry them, and are again by the next tide, brought *the same distance back!* That this is not the case is self-evident, for if it were, the Thames must have become, long since, choked up by the quantities of animal and vegetable matter daily entering it, and its current completely stopped; and yet we find that its depth and velocity have remained the same, or very nearly so, for ages. Further, if the case were as it has been stated, we must imagine that the same body of water has flowed backwards and forwards in the Thames *for ever*, whereas we know that there is a continual *transmission* or *interchange* of water, received from the upper sources of the river, and from the numerous tributary rivers and streams which empty themselves into it, during its progress from its sources to the sea. That the Thames must in fact carry with it, in its fall to the sea, all the impurities which it has collected in its course, is so self-evident, that the only wonder is how the contrary could ever have been asserted.

"The tide at London Bridge, under ordinary circumstances, runs upwards about *five hours and a half*, and downwards *or towards the ocean*, about *seven* hours. This occurring twice in 25 hours causes the difference of high water at London to be an hour later every day. The variations of spring and neap tides, of much or little upland water, from an abundance or deficiency of rain, are to be considered,—still the tide *flows downwards during a longer period than it does upwards*, and the stream is *stronger* or *more rapid* in its course towards the ocean, by which the impurities which it has collected in its course are conveyed away, and a volume of *fresh water daily brought* into the Thames at London."

* * * *

"It must be recollected also, that in the latitude of London, westerly and south-westerly winds prevail for at least nine months out of the twelve, and consequently, the declination or fall of the river being in that direction, contribute powerfully towards cleansing the channel of the river. It has also been found that the drainage of London does not materially affect the middle of the stream during the ebb, a sample of water taken at London Bridge during the last hour of the ebb, being nearly as bright as it could have been if taken at Richmond, and it is therefore probable, that for a long period of the flood, the centre of the river remains *unaffected by drainage water*."

Let us see now how far the allegations made with respect to the *superior* purity of such tributaries to the Thames, as the Wandle and Colne, are borne out by evidence.

"As the water of the Wandle has been extolled as being pre-emiently *pure*, it will be well to examine what claims to *superior purity* this river possesses over the Thames. In the first place, it is well known that there are numerous bleaching-mills, paper-mills, oil and snuff-mills on this river, and that in the preparation of some of these substances, deleterious ingredients are used, the refuse of which finds its way into the river. Mr. J. Simpson states in his evidence, page 120, that the Wandle is a river which may be said to be subject to contamination almost from its very source, owing to the different bleaching works on it, and to other causes. The water is also frequently in a very turbid state, especially in the winter months, owing to the prevalence of floods, and the quantity of land drainage. Dr. William Lambe made some experiments on the water of this river in the summer of 1834, which proves that it contains a large proportion of *organic matter* in various stages of decomposition, either mixed or dissolved in it, and that in fact this water, instead of being remarkable for its purity, as has been asserted, is, on the contrary, *the very reverse* of pure."

* * * * * * *

"With respect to the water of the Colne, Mr. Telford's experiments clearly proved that this river was totally inadequate in quantity for the supply of even *three* out of the five Water Companies on the north of the Thames, and that with regard to *quality*, it is frequently in so turbid and muddy a state, caused by its flowing over a *red soil*, as to be totally unfit for use."

The following general observations are most sensible and judicious.

"Purity in water must, in fact, ever be comparative; all that can be expected is to obtain it without much saline impregnation, and in a state most free from palpable impurities: or, in other words, most exempt from adventitious or unwholesome substances in mechanical mixture or in chemical solution. As a general rule, it may be laid down, that that water will be the best, whose exposure to the light and air has been the longest, and whose state of motion has been the greatest. Thus the Thames, flowing through an extensive tract of country, can only receive into its composition, those bodies which form the nature of the soil through which it passes, together with the drainage from the respective towns and vil-

ages on its stream. These being so largely diluted by upland water are partly deposited and partly diffused through such a volume, and in some measure decomposed by the abundant vegetation at the bottom and sides of the Thames, so as to free the water from all inportant objections*. It is true that when it enters the bounds of the metropolis, the foreign matters which it receives, render it unfit for immediate use, but as the adulteration is immediate and local, the impurities it receives have not sufficient time afforded them to amalgamate effectually with its other component parts, and by submitting it to the clarification of a properly constructed filter, its purity is restored without its losing those beneficial properties which as a running stream it has acquired. The attempt, therefore, of obtaining water for the capital of greater purity than the Thames, by seeking the source of supply from any spring or rivulet a few miles distant, is a work of supererogation, and will not be likely to answer.

"It has been said that, submit Thames water to whatever process you may, you can never render it as pure as that which is procured immediately from a spring. That this is a misconception may be easily proved, for we know that all springs which we are accustomed to call "pure," are only rendered so from the effects of a natural filtration in the bowels of the earth.

"All springs, it is clear, must partake of the nature of the soils through which they pass; consequently they will all be found, more or less, to possess different qualities, and will in most cases, have acquired that property called "hardness," which renders them unfit for washing with, or of forming a lather with soap. Simple filtration, as is well known, can only produce transparency, by arresting such particles of matter as are in a state of mechanical mixture with the fluid, for any matter which is held in chemical solution in the fluid, will pass with it through the pores of the most minute filter, unless the substance of the filter itself have a *greater affinity* for such matter than the fluid which contained it. In this case a new combination will be formed, and the matter in solution, leaving the fluid, will be taken up by the filter, not simply because the passages are too small to permit the particles to pass through, but on account of the *superior attraction* existing between the substance of the filter and the dissolved matter.

"In applying this reasoning to springs, we find a reason why so few (if any) springs produce *pure* water, although it may always be transparent, for the great natural filters which produce springs, are almost always on an opposite principle, namely, that the substance which composes the filter, has a great affinity for the water, and its particles are thereby taken up slowly in solution and carried off, at the same time that the extraneous matters, which are only mechanically mixed with the water, are detained in the pores of the filtering strata: thus we find few springs that have not some mineral held in solution by the water, although it may be and generally is, invisible to the eye. The most common mineral taint which spring water receives in its natural filtration, is sulphate of lime, or plaster of Paris: this renders the water "hard" as it is called, so, that it will not produce a lather with common soap, but curdles it. Muriate of soda is also commonly found in the springs from the chalk strata beneath the London clay. Sulphate of iron as well as carbonate of iron in a state of solution, are also frequently met with in springs; such waters may be known by the dark orange-coloured film which generally appears upon their surface.

"From all these causes it is found that the turbid and foul waters of large rivers, when altered by art so as to separate from their extraneous mixtures, *are more pure* as well as *wholesome* as a beverage, *than the generality of spring water*. It may, however, be proper to observe, that as a simple beverage, the purest water, as for instance that which has been distilled is not considered as the most pleasant to the palate, in consequence of its being deprived of the gas, which gives the briskness to spring waters, but which at the same time renders them capable of dissolving earthy or saline ingredients, thus causing them to be more or less hard, and in the same proportion *less proper* for the laundry and other domestic purposes."

The water of large rivers, however, such as the Thames must, as the author very properly insists, be duly purified by filtration; and the only efficient plan for this purpose, is in his judgment, to pass it through beds of fine sand and *charcoal*, after the manner practised to some extent at Paris, with the water of the Seine. Of the sand and gravel system, adopted at the Chelsea Water Works,—the only metropolitan works where filtration is employed — he truly observes, that "although the water thus filtered may be, and is rendered perfectly clear and transparent, it is not thereby freed from the matters that it may hold in solution."

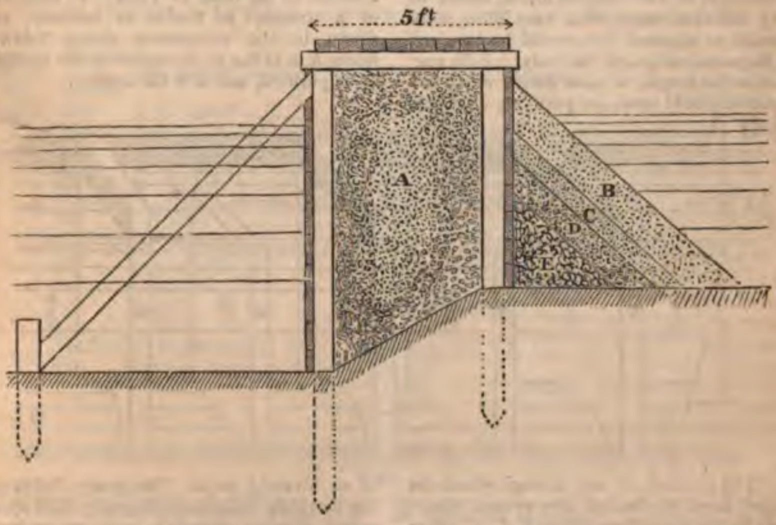
* This valuable fact has been explained by Professor Brande, at the Lectures in the Royal Institution, with his usual clearness. It has been proved that the water in ponds and rivers is rendered more *pure* by the vegetation of aquatic plants which absorb carbonic acid, and yield oxygen gas.

and which are usually the most deleterious of all foreign admixtures. The efficacy of charcoal in not only *clarifying* but *depurating* water, is a fact well known, but the following experimental evidence of it will bear repetition.

"From some experiments that were made by Mr. Lowitz, of St. Petersburg, on the effects of charcoal in preventing the putrefaction of water, and in restoring fetid, bad-tasted and discoloured water, to an inodorous, tasteless, transparent, and colourless liquid, and for which Mr. Lowitz received a medal from the Imperial Economical Society of St. Petersburg, it was found that some water in a wooden vessel, with a quantity of charcoal in powder, kept perfectly sweet for *four* weeks in hot weather, and will not putrefy at all, while the same kind of water without charcoal, became fetid in a very few days. Charcoal seems even capable of preserving water for any length of time: for some water that was kept mixed with charcoal *for a whole year*, did not become in the slightest degree putrid. This effect seems to be owing to the peculiar property which charcoal possesses of *absorbing* the gases and the putrid particles immediately as they are formed, and thus preventing them from acting as a ferment to the rest of the water."

The author gives in an appendix a very good plan of a filtering apparatus, in which charcoal is made to play the principal part; and this with the illustrative engravings, we shall take leave to extract at length.

PROPOSED FILTERING APPARATUS. SECTION.



Reference. — A. Charcoal medium, (the finest in the centre.)

B. Fine sand.

C. Coarse sand, and shells.

D. Fine gravel, and pebbles.

E. Large gravel and broken pottery.

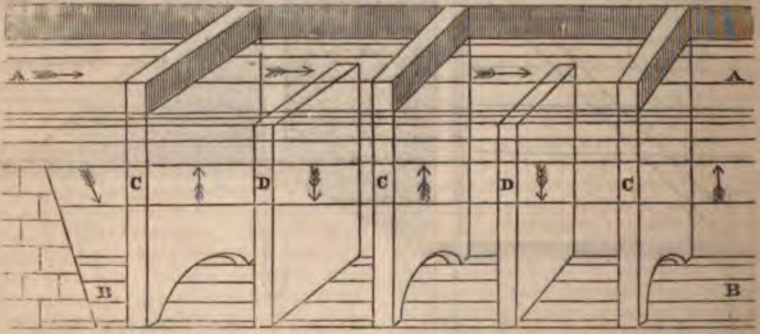
"The above is a sketch of a filtering apparatus, in which charcoal is proposed to be employed, both in a fine and coarse state, the finest being in the centre, as shewn. In this case, lateral filtration by a head of water, is to be preferred to an extended surface over which the filtering materials are laid, and where the water percolates through, as, in the first place, the materials, (the charcoal in particular,) will be more accessible at all times for cleansing, or renewing, when required. The charcoal, in fact, might be taken out and renewed, without interfering in the slighest way with the rest of the filtering materials, being separated from the gravel and sand, by the perforated planking, as shewn in the sketch.

"In the next place, the disposition of the sand, &c., the finest being placed outermost, at its natural slope of about 30° or 35°, would in a great measure supersede the necessity for having the surface scraped frequently, as done at the Chelsea Water Works, for there would be a *natural tendency*, in pro-

portion as the outer layer of sand became loaded with the sediment and particles which it would arrest, for the sand to *slide down* to the base of the slope, where the sediment, &c., would accumulate, and from whence it might be easily removed. All that would be required in that case, would be to renew occasionally the outer layer of sand, which might be done with the greatest ease from the top of the filter-bank, without disturbing the remainder. It should be observed that where the sand comes in contact with the planking near the top of the structure, the planks should be laid with a close joint, to prevent the sand from being washed through.

"Thirdly, the proposed method would be far less expensive, as regards the first cost, than the method of filtering by descent; as the construction of the frame-work would be entirely of timber, it could be put together by any carpenter at a trifling expense. The plan proposed would, in fact, combine the advantages of two distinct filters, acting in very different ways, with very little more trouble or expense, than would be involved in the construction of one only. With respect to the length of time during which the charcoal would retain its purifying qualities, it appears from Mr. Lowitz's experiments, before mentioned, that charcoal retained its antiputrescent properties *for a whole year*; and therefore, if the supply had to be renewed but once in that time, the expense would be but small. This must be, however, a matter of experiment; probably it might be found that by removing the charcoal from time to time, washing it well, and *exposing it to the light and air*, for a few days, it would part with whatever putrescent particles it had absorbed from the water, and might be made use of over again.

"In order to facilitate the deposition and subsidence of the grosser impurities and sediment, previous to the water passing through the above filter-bank, a very simple and ingenious method might be employed, which has been put in practice with complete success in Switzerland, for purifying a stream of water, and which was described by Sir Henry Englefield, in the Philosophical Journal, so far back as 1804. It consists of a structure of timber or masonry, as shewn in the perspective sketch below, where A A is the upper surface of the stream to be purified, and B B the bottom.



"The channel, or cut through which the water flows is divided into several chambers by the parallel partitions C, C, C, alternately rising above the surface level of the stream, and *open at the bottom*, while the intermediate partitions D, D, do not rise *within several feet* of the surface, and are continued to the bottom. It is obvious that the course of the water must be in the direction of the arrows, and in this repeated slow ascent and descent, all floating impurities will be left at the top, while the sediment and heavier impurities will subside to the bottom. The sediment, &c., may be easily removed and the apparatus cleansed, by sending down persons between the walls, and *the operation* would be facilitated by giving *to the bottom* of the cut or canal, the form of an inverted arch. The spaces between the partition walls might be partly filled with coarse filtering materials, such as broken pottery, or coarse gravel and pebbles, &c."

P. S. Since writing the preceding notice, we find that the House of Lords Committee having directed Mr. Phillips to make an analysis of the different waters in and near London, that gentleman has made a report which establishes beyond all further possibility of dispute, the fact of the Thames water containing, even in an unfiltered state, a smaller portion of extraneous matter, than any of its tributaries. We subjoin a tabular view of the results of Mr. Phillips's experiments.

Place where Sample taken.		Measure and Weight of Sample.	Solid Contents of each Gallon.		Total of Saline Matters in each gal. or 70,000 grs.
			Carb. of Lime.	Sulph. of Lime and Salt.	
Thames.		*Quantity.* 1 imperial gallon.			
At Kew.	Source of the Grand Junction Water Works Company............	*Weight.* 10 lb. avoirdup. = 70,000 grains.	16 grains.	$3\frac{4}{10}$ grains.	$19\frac{4}{10}$
Barnes.	Source of the West Middlesex Water Works Company............	" "	$16\frac{9}{10}$	$1\frac{7}{10}$	$18\frac{6}{10}$
Chelsea.	Source of the Chelsea Water Works Company	" "	$16\frac{5}{10}$	$2\frac{9}{10}$	$19\frac{6}{10}$
Otter's Pool—Spring near Bushey..		" "	$18\frac{8}{10}$	$2\frac{5}{10}$	$21\frac{3}{10}$
Main Stream of Valley that Supplies the Colne		" "	$19\frac{3}{10}$	$2\frac{5}{10}$	$21\frac{8}{10}$
Colne—Near Bushey Mill..........		" "	$18\frac{1}{10}$	$3\frac{2}{10}$	$21\frac{3}{10}$

LIST OF DESIGNS REGISTERED BETWEEN 29TH APRIL, AND 26TH MAY, 1840.

1840. Date of Registration.	Number on the Register.	Registered Proprietor's Name.	Subject of Design.	Time for which protection is granted.
April 27	299	J. J. Mechi	Reflector	3 years
29	300	Butcher. Smith and Co....	Carpet	1
May 4	303	J. Dobson and Sons	Carpet bag......................	1
"	304	J. Woods	Plough share and blade............	3
"	305,6	W. Ryton and B. Walton..	Dish covers	3
"	307	C. Griffin	Kite	1
"	308	D. Wilkinson............	Reel	1
"	309	S. Cockings	Pen	3
"	310	J. S. Hall	Boot	1
"	311	F. Gye	Letter Balance	3
"	312	T. Ellis	Reflector	3
"	313,315	W. Ryton and B. Walton ..	Dish covers	3
"	316	Butcher, Smith and Co....	Carpet	1

LIST OF ENGLISH PATENTS SEALED BETWEEN THE 26TH APRIL AND 26TH MAY, 1840.

William Crane Wilkins, of Long-acre, lamp manufacturer, and Mathew Samuel Kendrick, of the same place, lamp-maker, for certain improvements in lighting and in lamps. April 28; six months to specify,

John Inkson, of Ryder-street, St. James's, gent., for improvements in apparatus for consuming gas for the purpose of light, being a communication from abroad. April 30; six months.

Orlando Jones, of the City-road, accountant, for improvements in treating or operating on farinaceous matters, to obtain starch and other products, and in manufacturing starch. April 30; six months.

William Peirce, of James-place, Hoxton, ironmonger, for improvements in the construction of locks and keys. May 2; six months.

Arthur Wall, of Bermondsey, surgeon, for a new composition for the prevention of corrosion in metals, and for other purposes. May 2; six months.

Thomas Gadd Matthews, of Bristol, merchant, and Robert Leonard, of the same place, merchant, for certain improvements in machinery or apparatus for sawing, rasping, or dividing dyewoods or tanner's bark. May 5; six months.

William Newton, of Chancery-lane, patent agent, for an improved apparatus and process for producing sculptured forms, figures, or devices in marble, and other hard substances, being a communication from a foreigner residing abroad. May 5: six months.

George Mackay, of Mark-lane, ship-broker, for certain improvements in rotary engines, being a communication from abroad. May 5; six months.

William Beetson, of Brick-lane, Old-street, brass-founder, for improvements in stuffing boxes applicable to water-closets, pumps, and cocks. May 5; six months.

Frank Hills, of Deptford, manufacturing chemist, for certain improvements in the construction of steam-boilers and engines, and of locomotive carriages. May 5; six months.

Bernard Aubé, of Coleman-street Buildings,

gent., for improvements in the preparation of wool for the manufacture of woollen and other stuffs. May 7; six months.

Thomas Walker, of Gallashiels, Selkirk, mechanic, for improvements in apparatus applicable to feeding machinery, employed in carding, scribbling, or teazing fibrous materials. May 7; six months.

Henry Holland, of Darwin-street, Birmingham, umbrella furniture maker, for improvements in the manufacture of umbrellas and parasols. May 7; six months.

Henry Montague Grover, of Boveney, Buckingham, clerk, for an improved method of retarding and stopping railway trains. May 9; six months.

Miles Berry, of Chancery-lane, patent agent, for certain improvements in treating, refining, and purifying oils, being a communication from abroad. May 9; six months.

Auguste Moinan, of Philpot-terrace, Edgeware-road, clock-maker, for certain improvements in the construction of time-keepers. May 9; six months.

Rice Harris, of Birmingham, gent., for certain improvements in cylinder plates and blocks, used in printing and embossing. May 12; six months.

George John Newbery, of Cripplegate-buildings, manufacturer, for certain improvements in rendering silk, cotton, woollen, linen, and other fabrics, waterproof. May 12; six months.

Henry Dircks, of Liverpool, engineer, for certain improvements in the construction of locomotive steam-engines, and in wheels to be used on rail and other ways, parts of which improvements are applicable to steam engines generally. May 12; six months.

John Davidson, of Leith-walk, Edinburgh, for an improvement in the method of preserving salt. May 12; six months,

Peter Bradshaw, of Dean, near Kimbolton, Bedford, gent., for improvements in dibbling corn and seeds. May 12; six months.

James Walton, of Sowerby Bridge, Halifax, cloth-dresser, for improvements in the manufacture of beds, mattrasses, pillows, cushions, pads, and other articles, of a similar nature and in materials for packing. May 12; six months.

Richard Foote, of Faversham, watch-maker, for improvements in alarums. May 12; six months.

John Joseph Mechi, of Leadenhall-street, cutler for an improved method of lighting buildings. May 12; two months.

Bryan J. Anson, Bromwich, of Clifton-on-Teme, Worcester, gent., for improvements in stirrup-irons. May 13; six months.

Henry Ernest, of Gordon-street, gent., for certain improvements in the manufacture of machines usually called beer-engines. May 13; six months.

William Hannis Taylor, of Norfolk street, Strand, Esq., for certain improvements in the mode of forming or manufacturing staves, shingles, and laths, and the machinery used for that purpose. May 20; six months.

William Bush, of Camberwell, merchant, for improvements in fire-arms and in cartridges, being a communication. May 20; six months.

James Buchanan, of Glasgow, merchant, for certain improvements in the machinery applicable to the preparing, twisting and spinning of hemp, flax, and other fibrous substances, and certain improvements in the mode of applying tar or other preservative to rope and other yarns. May, 22; six months.

James Callard Davies, of College-place, Camden Town, jeweller, for an improved clock or time-piece. May 23; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND BETWEEN 22ND APRIL AND 22ND MAY, 1840. TIME FOR SPECIFICATION IN EACH CASE FOUR MONTHS.

Orlando Jones, of the City Road, Middlesex, *accountant, for* improvements in treating or operating on farinaceous matters to obtain starch and other products, and in manufacturing starch. Sealed May 6.

Francis Gybbon Spilsbury, of Walsall, Staffordshire, chemist, Marie Francois Catherine Doetzer Corbaux, of Upper Norton-street, Middlesex, and Alexander Samuel Byrne, of Montague Square, of Middlesex, gentleman, for improvements in paints, or pigments and vehicles, and in modes of applying paints, pigments and vehicles. May 7.

Joseph Clinton Robertson, of 166, Fleet-street, London, Patent Agent, being a communication from abroad, for an improved method or methods, of obtaining mechanical power from electro magnetism, and the engine or engines by which the said power may be made applicable to motive purposes. May 7.

John Wilson, of Liverpool, lecturer on chemistry, for an improvement or improvements in the process or processes of manufacturing the carbonate of soda. May 11.

Antoine Blanc, of Paris, merchant, and Theophile Gervais Bazille, of Rouen, merchant, now residing at Sublonière's Hotel, Leicester-square, Middlesex, being a communication from abroad, for certain improvements in the manufacturing or producing soda and other articles obtained by, or from the decomposition of common salt or chloride of sodium. May 11.

Robert Gill Ransom, of Ipswich, paper-maker, and Samuel Milbourn, of the same place, foreman to the said Robert Gill Ransom, for improvements in the manufacture of paper. May 13.

Thomas Myerscough, of Little Bolton, county of Lancaster, manager, and William Sykes, of Manchester, machine maker, for certain improvements in the construction of looms, for weaving or producing a new or improved manufacture of fabric, and also in the arrangement of machinery to produce other descriptions of woven goods or fabrics. May 13.

James Knowles, of little Bolton, county of Lancaster, coal merchant, for an improved arrangement of apparatus for regulating the supply of water to steam boilers. May 13.

Henry Trewhitt, of Newcastle on Tyne, Esq., for certain improvements in the fabrication of china or earthenware, and in the machinery or apparatus applicable thereto. May 15.

William Winsor, of Rathbone Place, Middlesex, artists' colourman, for a certain method, or certain methods, process or processes for preparing, preserving and using colours. May 13.

William Craig, of Glasgow, engineer, and William Douglas Sharp, of Stanley, Perthshire, engineer, for certain improvements in machinery for preparing, spinning and doubling cotton, flax, wool, and other fibrous substances. May 18.

Alexander Angus Croft, of Greenwich, manufacturing chemist, for certain improvements in the processes of manufacturing gas, and in the production of ammoniacal salts. May 19.

John Davidson, salt manufacturer, Leith Walk, near Edinburgh, for an improvement in the method of preserving salt. May 19.

With deep sorrow we have to announce the death on the 22nd instant, in the 29th year of his age, of Mr. William Angus Robertson, for several years past the Assistant Editor and Publisher of this Magazine. Of a mild and amiable disposition—an ingenious, enquiring and well-stored mind—most upright principles and conduct—and habits of remarkable industry and application—his early decease will be generally and deservedly lamented.

END OF THE THIRTY-SECOND VOLUME.

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